Biomark®

SPECIALISTS IN ELECTRONIC IDENTIFICATION

FS2020™ Stationary Transceiver User Manual

Initial Release

Firmware Version: 1.3

Biomark, Inc.

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Document History

Release Date	Doc Version	Firmware Version	Comments
April 2011	Draft	1.00D	Review version of this manual.
November 2012	Initial release	1.3	Initial release of this manual.

READ THROUGH THIS ENTIRE MANUAL BEFORE INSTALLING AND OPERATING YOUR TRANSCEIVER. FOLLOW ALL STEPS EXACTLY. USING THE TRANSCEIVER IN A MANNER FOR WHICH IT WAS NOT DESIGNED MAY IMPAIR THE SAFETY FEATURES BUILT IN BY THE MANUFACTURER.

Safety Symbols

	Indicates care should be taken to avoid physical harm. Only qualified service personnel should access the internal components of the transceiver.

.

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Product Description

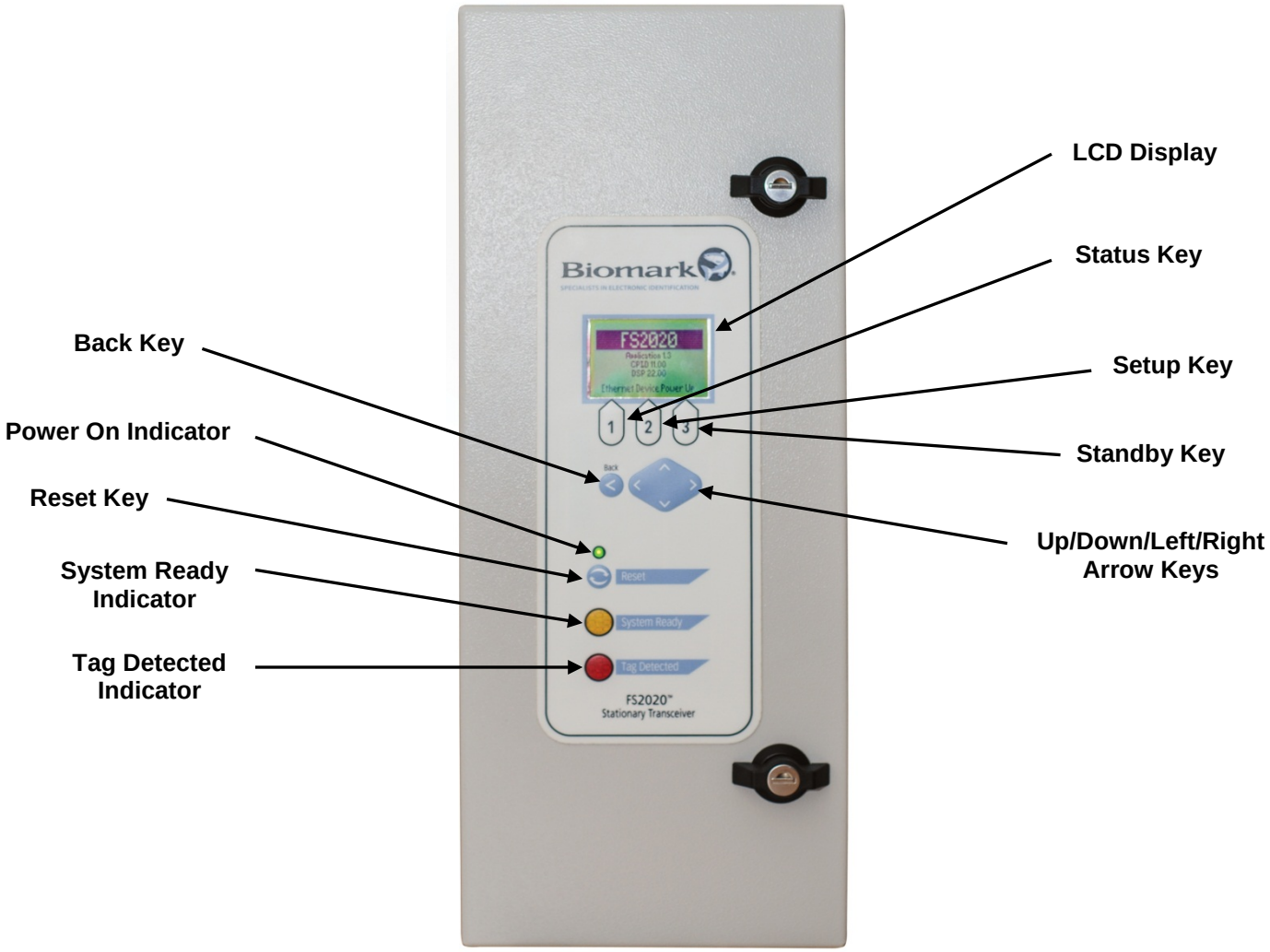
The FS2020™ is a powerful, high speed ISO compliant stationary RFID transceiver designed for detecting, storing, and transmitting FDX-B and HDX PIT tag IDs in permanent installations. The unit incorporates the following features:

- Dynamic antenna auto-tuning
- Support for a wide range of antenna inductances
- Adjustable antenna output power
- DSP powered detection of ISO-compliant FDX-B PIT tags
- Detection of ISO-compliant HDX PIT tags
- Automatic system performance diagnostic utilizing virtual tag test
- Data logging memory capable of storing up to 15,600 tag IDs and 151 status reports
- Configurable non-volatile setup parameters
- LCD graphical display with an easy to navigate menu
- USB port for local operation
- Ethernet and fiber optic ports for remote operation
- Synchronization capability for multiple readers
- AC power input
- Field upgradeable firmware

Specifications

Item	Description
Input Voltage	100-240 V AC, 45-65 Hz
Input Current Consumption	1.4 A Max.
Input Fuse	3 A, Slow-Blow
Antenna Exciter Voltage	10-16 V DC, Manually Adjustable
Antenna Exciter Configuration	Half-Bridge
Antenna Current Limit	5.0 Ap-p
Antenna Tuning	8 Capacitors, Manually Switched 6 Capacitors, Electronically Switched
Operating Frequency	134.2 KHz
Tag Technologies Decoding	ISO FDX-B ISO HDX
DSP	FDX-B Decoding Enhancement
Virtual Tag Test	Detection Self-Diagnostic Manually Adjustable Level
Data Storage	15,600 Tag IDs 151 Status Reports
Antenna Port	Circular Plastic Connector (9 Positions Receptacle)
Communication Ports	USB (Mini-B): ASCII Protocol Ethernet (RJ45): ASCII / BPA Protocols Fiber Optics (ST): ASCII / BPA Protocols
Synchronization Capability	Antenna Exciter Clock Synchronization Chain Configuration Hardwired Twisted-Pair Interface
Display	Graphical LCD, Backlit
External LEDs	Power On (Green) System Ready (Yellow) Tag Detected (Red)
Buzzer	Piezo Indicator, 4 KHz, 70 dB
Keypad	9 Keys, Content-Sensitive
Operating Temperature Range	-4˚F to 149˚F (-20˚C to 65˚C)
Operating Humidity Range	0% to 80%, Non-Condensing
Operating Altitude	Sea Level to 6500 ft. (2000 meters)
Operating Environment	Pollution Degree 2
Enclosure	NEMA 4x, IP66 Rated Steel Box
Weight	16.6 lbs. (7.5 kg)
Dimensions	21.0” L x 8.0” W x 5.9” H (53.5 cm x 20.5 cm x 15.0 cm)
Agency Approvals	UL

Control Panel Component Identification



Front View of the FS2020™

1. **Display:** LCD graphical display.
2. **Status Key:** Used to check the current status of the transceiver parameter settings.
3. **Setup Key:** Used to change the transceiver parameter settings.
4. **Standby Key:** Places the transceiver into standby mode.
5. **Up/Down/Left/Right Arrow Keys:** Used to navigate through the transceiver menus.
6. **Back Key:** Moves the display to the previous menu.
7. **Power On Indicator:** This green LED glows solid when power is turned on to the unit.
8. **Reset Button:** Resets the transceiver.
9. **System Ready Indicator:** This yellow LED indicator slowly flashes as the system powers up, then when transceiver is in scan mode either glows solid (if only FDX-B detection enabled) or flickers rapidly (if HDX detection enabled).
10. **Tag Detected Indicator:** This red LED indicator flashes each time a tag ID is successfully decoded.

Port Identification

Bottom View of the FS2020

Antenna Port: Used to connect the transceiver to an RFID antenna.

Pins assignment:

- Pin 1 – Antenna -
- Pin 6 – Shield
- Pin 7 – Antenna +

Sync In Port: Used to synchronize with another transceiver by receiving the other unit's antenna exciter clock signal.

Pins assignment:

- Pin 1 – Reference (0V)
- Pin 3 – RX +
- Pin 4 – Shield
- Pin 6 – RX -

Sync Out Port: Used to synchronize the transceiver with another unit by feeding the transceiver's antenna exciter clock signal to the other unit's Sync In port.

Pins assignment:

- Pin 4 – Shield
- Pin 5 – TX +
- Pin 7 – Reference (0V)
- Pin 8 – TX -

Gate Out Port: This is an auxiliary port that is used for triggering a site-specific action (such as moving a gate within a flume) whenever a tag is detected. This port operation depends on the Detection Unique Mode setting and is similar to the transceiver buzzer operation, except it is not triggered by VTT detection. Each time a tag ID is detected and satisfied Detection Unique Mode criteria the internal semiconductor switch is closed for 15 milliseconds.

Pins assignment:

- Pin 1 – Switch +
- Pin 2 – Switch -
- Pin 4 – Shield

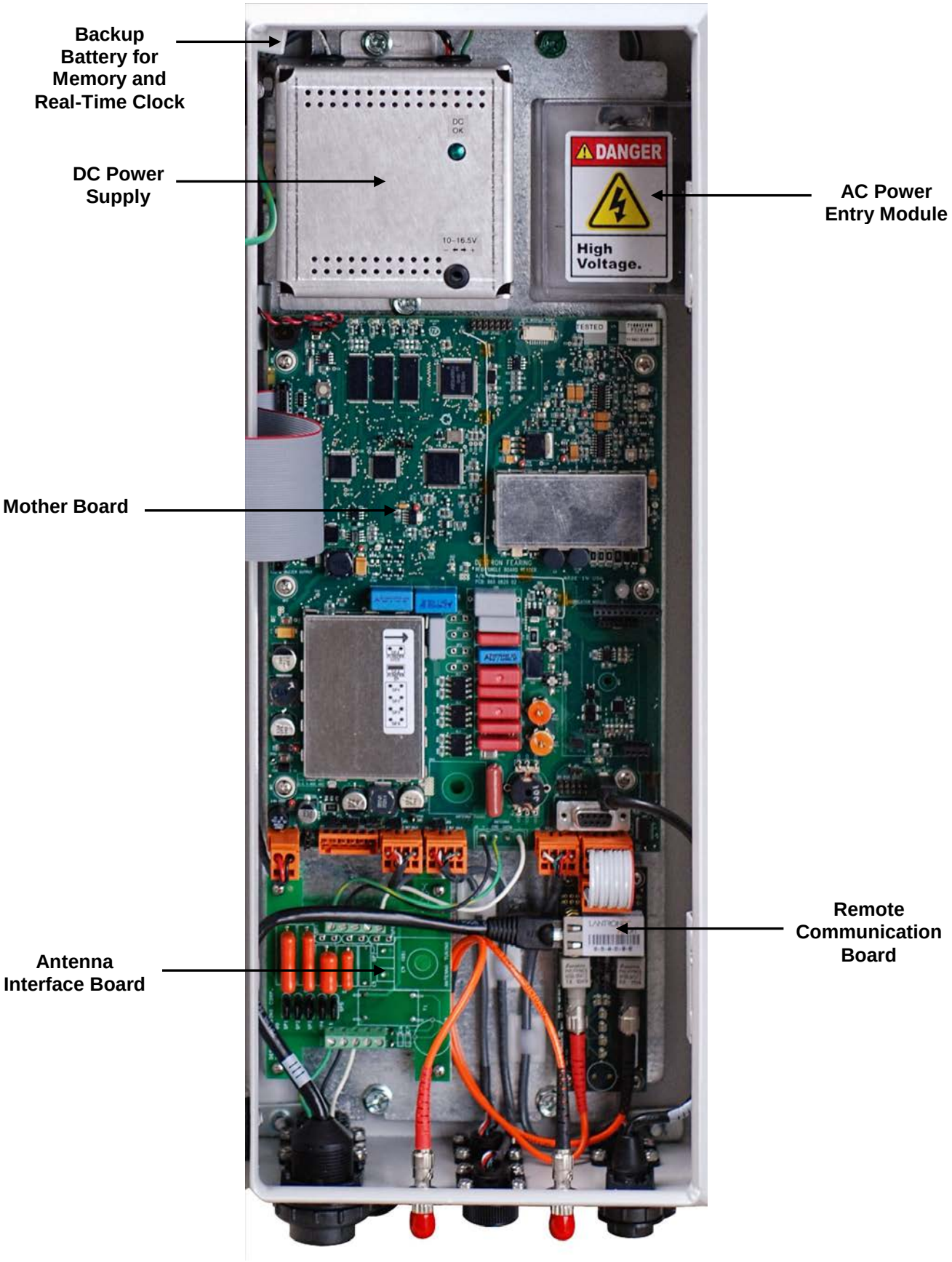
Fiber Optic Transmit Port (remote communication port): Used to transmit data to a remote device through a fiber optic network.

Fiber Optic Receive Port (remote communication port): Used to receive data from a remote device through a fiber optic network.

Ethernet Port (remote communication port): Used to monitor and operate the transceiver from a remote location through a local area network (LAN).

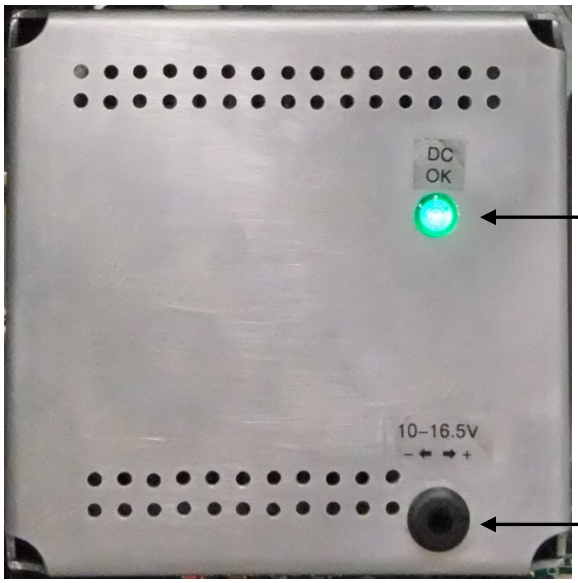
USB Port (local communication port): Used to monitor and operate the transceiver from a local device such as a laptop computer.

Major Internal Hardware Components



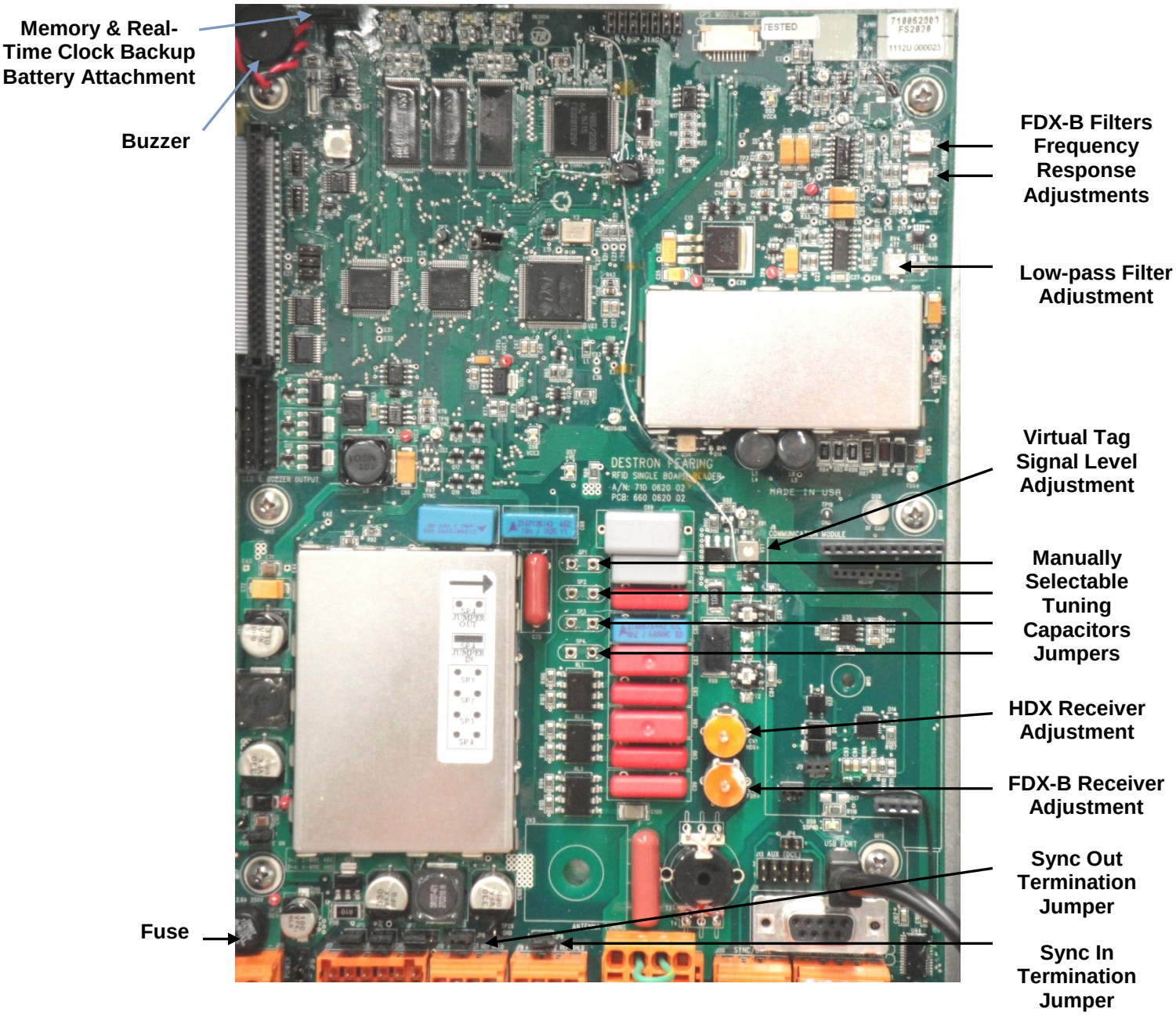
DC Power Supply

The DC Power Supply converts 120-240V AC into adjustable 10-16.5V DC. This DC voltage is used as Mother Board input voltage, specifically Antenna Exciter input voltage, which in turn is converted into antenna current and antenna output power (antenna magnetic field strength).



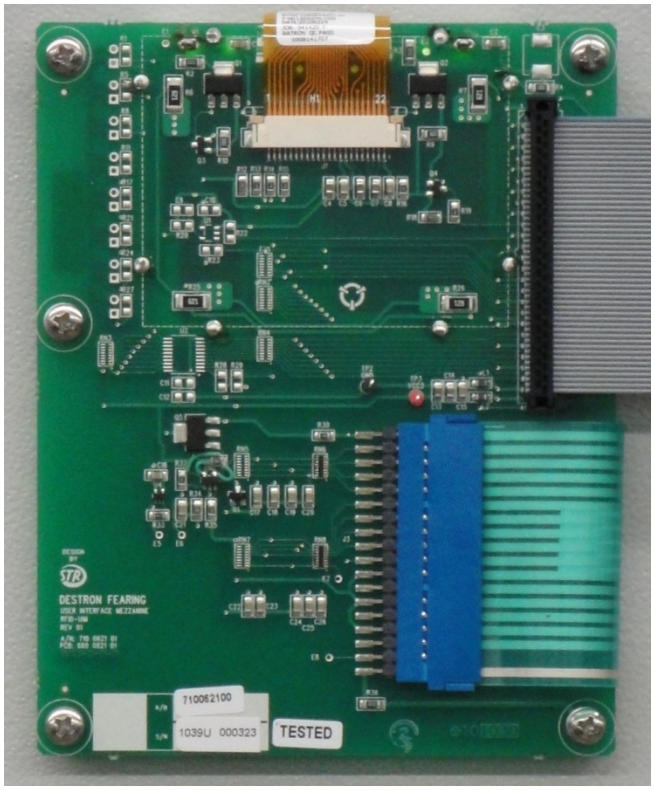
Mother Board

The Mother Board is the main module of the transceiver. It contains all major functional segments of the circuitry as well as input fuse, main tuning capacitors bank (manually and electronically selectable), Virtual Tag signal level adjustment, and FDX-B and HDX signals receivers' adjustments.



User Interface Board

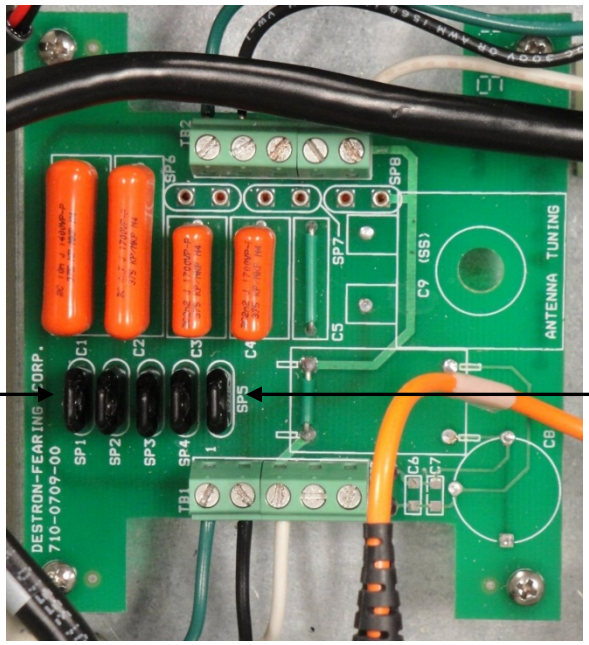
The User Interface Board incorporates the graphic LCD and the keypad interface. There are no adjustments on this board.



Antenna Interface Board

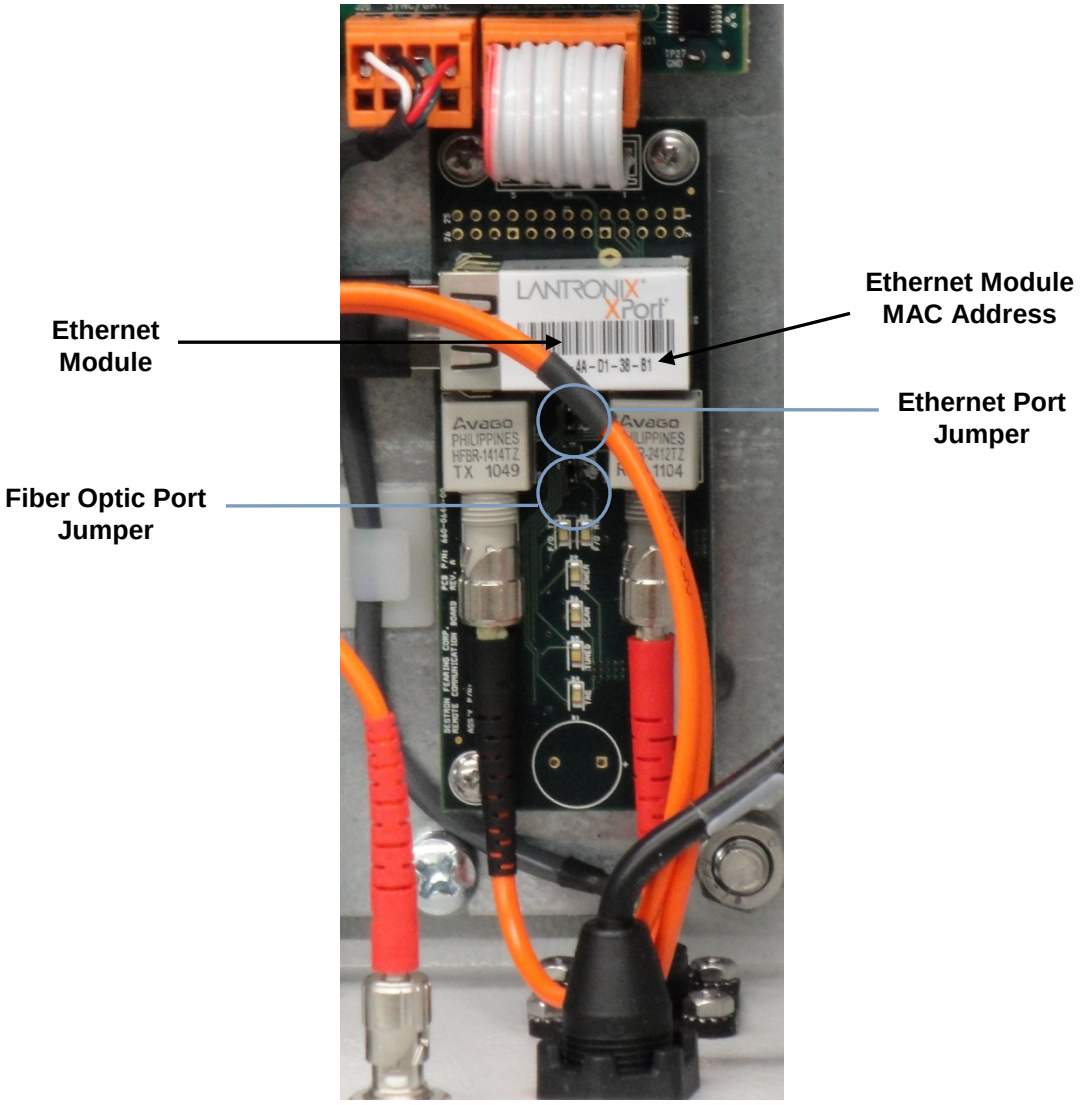
The Antenna Interface Board incorporates an additional bank of manually selectable tuning capacitors that are connected in series with the main tuning capacitors bank on the Mother Board. The Antenna Tuning Board contains five jumpers: the four jumpers on the left (SP1-SP4) control the four associated capacitors located directly above the jumpers; the rightmost jumper (SP5) is a bypass that disables these four capacitors. This bank typically should be used for tuning an antenna that does not have any additional capacitors connected in series directly to its coil.

Note: The need for using these capacitors depends not only on the antenna inductance, but also on the capacitors setting at the antenna and the properties of the antenna cable**.**



Remote Communication Board

The Remote Communication Board incorporates the Ethernet and fiber optic communication interface. It contains two jumpers that enable the Ethernet and the Fiber Optic ports. To disable one of the ports (for example, to save on power consumption), remove the corresponding jumper.



Installation and System Configuration

Installing and Powering Up the Transceiver

1. Remove transceiver and all items from the shipping carton.
2. Check for correct content.
3. Locate an area to mount the transceiver.

   The transceiver is designed for indoor use or installation into a NEMA 4 cabinet. It must be mounted on a medium or high density vertical surface (such as wood, metal, concrete, etc.) using ¼ inch bolts or screws within six feet of a grounded AC power source, away from direct sun light and away from any water. Use the included mounting template to establish the proper mounting holes' locations.

   Do not position the transceiver in a location that is difficult to reach or operate.
4. Use the four mounting brackets on each corner to mount the transceiver.

   The hardware required to mount the transceiver at the site is not included.
5. Verify that transceiver power switch located on the AC power entry module on the right side of the transceiver is in off position ("0") and then install the power cord.

   The power cord plugs into the AC power entry module. Make sure the transceiver is properly grounded.
6. Connect the antenna cable to the antenna port on the transceiver.

   After plugging the antenna cable into the antenna port, twist the locking ring to secure the cable in place.

   For instructions on tuning the antenna, see page 13.
7. Connect the transceiver to a local computer and/or to your network.

   For instructions on establishing a connection with the transceiver, see page 40.
8. (Optional) If you are using multiple transceivers, install the synchronization cables.

   For instructions on how to synchronize multiple transceivers, see page 18.
9. (Optional) If you have a device that will perform a site-specific action (such as moving a gate within a flume) whenever a tag is detected, attach the device cable to the Gate Out port.
10. Make sure that all tuning jumpers on the Mother Board and on the Antenna Interface Board are installed.
11. Toggle the power switch to on position ("I").

    The main screen is displayed. See page 21 for details.

Tuning the Antenna

Coarse-tuning the Antenna

The antenna tuning procedure should be performed after the initial installation of the transceiver. The transceiver incorporates a total of eight manually selectable tuning capacitors for coarse-tuning and six electronically selectable capacitors for fine-tuning the antenna. The capacitors are split into two banks:

- The main bank is located on the Mother Board and consists of four manually selectable and six electronically selectable tuning capacitors. They provide a total tuning capacitance ranging from 10nF to 128.9nF.
- The secondary bank is located on the Antenna Interface Board and consists of 4 manually selectable tuning capacitors. This bank is connected in series with the main bank and is used to reduce the total tuning capacitance, ranging in this case from 0.9nF to 15.7nF. This bank typically should be used for tuning an antenna that does not have any additional capacitors connected in series directly to its coil. This bank can be switched out of the circuitry (shortened) using jumper SP5, which is located on the Antenna Interface Board.

The coarse tuning procedure is as follows:

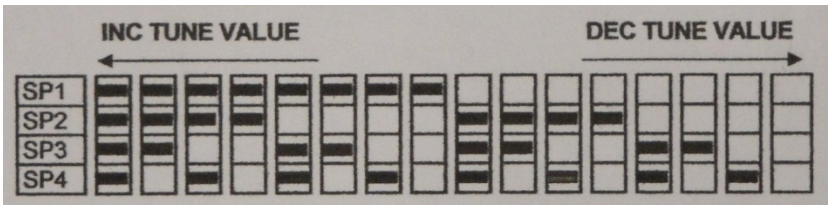
Note: Make sure that all the steps from installation procedure have been completed before tuning the antenna.

When the transceiver powers up it performs a quick auto-tuning process that determines if the antenna is connected to the transceiver and if it can be tuned using the six electronically selectable tuning capacitors.

- If the antenna is successfully tuned a confirmation message will be displayed and the selected dynamic capacitors setting will be reported to the enabled communication ports. In this case you can skip this section and proceed to *Fine Tuning the Antenna* on page 14.
- If the auto-tuning process fails an alarm is sent to the enabled communication ports and one of the following messages will be displayed.

1. If **NO ANTENNA CONNECTED** is displayed, check the antenna for the proper connection and antenna integrity. Also, note that if the antenna is too far out of tuning range the transceiver may not detect any current in the antenna and will generate this message as well. In this case decrease the tuning capacitance of the transceiver and re-tune the antenna (see Step 3).
2. If **INC TUN CAPACITANCE** is displayed and if all tuning jumpers are installed (and they are all installed when the transceiver is shipped), increase the capacitance at the antenna or increase the antenna inductance.
3. If **DEC TUN CAPACITANCE** is displayed, decrease the total tuning capacitance by removing one or more of the tuning capacitors jumpers on the Mother Board (see page 8). Use the diagram below to determine the next lowest capacitance jumper setting. (This diagram is located on the inside of the transceiver enclosure door).

   Note: To avoid possible injury or damage to the equipment it is recommended that you switch the transceiver to standby mode or switch off power before moving the tuning capacitors jumpers.



4. Reinitiate the auto-tuning process either by powering the transceiver back on or by selecting **Setup > Antenna > Antenna Full Tune**.
5. Repeat Steps 1 – 4 until either the antenna is successfully tuned or until all the tuning jumpers on the Mother Board are removed.
    - If the antenna is successfully tuned you can skip the remainder of this section and proceed to *Fine Tuning the Antenna* on page 14.
    - If you have removed all the tuning jumpers on the Mother Board and the antenna is still not tuned, proceed to Step 6.
6. If all tuning jumpers on the Mother Board are removed and **DEC TUN CAPACITANCE** is still being displayed, switch in the secondary tuning capacitors bank by removing jumper SP5 on the Antenna Interface Board (see page 10).
7. Reinstall all tuning jumpers on the Mother Board and reinitiate the auto-tuning process.
8. Repeat Steps 1 – 5 until all tuning jumpers on the Mother Board are removed.
9. If all tuning jumpers on the Mother Board are once again removed and **DEC TUN CAPACITANCE** is still being displayed, decrease the total tuning capacitance by removing one or more of the tuning capacitors jumpers on the Antenna Interface Board.

    Use the same diagram (above) to determine the next lowest capacitance jumper setting.
10. Repeat Steps 1 – 5 until the antenna is tuned or until all the tuning jumpers on the Mother Board and the Antenna Interface Board are removed.
11. If all tuning jumpers on the Mother Board and the Antenna Interface Board are removed and **DEC TUN CAPACITANCE** is still being displayed, decrease capacitance at the antenna or decrease antenna inductance and repeat the tuning process.

This concludes the antenna coarse-tuning process. During this process the manually switched capacitors setting is determined for the antenna so that it is within the tuning range of the electronically switched capacitors.

Fine-tuning the Antenna and Dynamic Tuning

The next step is to perform the antenna full tuning process. You do this by selecting **Setup > Antenna > Antenna Full Tune**.

During this process the transceiver goes through every possible electronically switched capacitors setting combination to tune the antenna more precisely. There are total of 64 setting combinations (0 to 63) providing a tuning range from 10nF to 19.8nF.

- Setting “0” means all capacitors are switched off and the tuning value is at a minimum – 10nF
- Setting “63” means all capacitors are switched in and the tuning value is at a maximum – 19.8nF.

The transceiver will select the final capacitors setting that produced the highest antenna current. At the same time the antenna signal phase measurement is taken and saved as the **tuning target phase** value. This value will be used by Dynamic Tuning (when enabled) to track any

changes to the environment (such as water depth, ambient temperature, foreign objects presence, components deterioration, etc.) that resulted in antenna de-tuning and to adjust capacitors setting accordingly to re-tune the antenna. When the antenna de-tunes it means its signal phase has deviated from the target value. Dynamic tuning tracks this phase deviation to determine when and what adjustments to make to the capacitors setting to return the phase value to the target value and in turn re-tune the antenna. The adjustments are done gradually, so there is no interruption of tag detection. If there is any tag detection interruption it is due to the antenna being out of tune until dynamic tuning re-adjusts it.

Dynamic tuning has a finite range, so not all changes in antenna tuning can be recovered using digitally switched capacitors. Considering this, it is recommended to adjust the manually switched capacitors setting so that the final dynamic tuning capacitors setting is as close to the mid-range as possible.

There are customizable alarms available that can notify you in advance of approaching the limit of the dynamic tuning range. Alarms will also notify you if the antenna is out of range and they will suggest the direction of changes to make to the manually switched capacitors setting.

Setting the Antenna Dynamic Tuning Responsiveness

The responsiveness (sensitivity) of the Dynamic Tuning can be adjusted by changing the **Antenna Dynamic Tuning Phase Deviation Threshold** value. The Dynamic Tuning will not attempt any tuning capacitance adjustments until the phase deviation value does not exceed the threshold setting in either direction. This value should be set smaller for high Q systems where smaller antenna tuning changes can result in larger detection degradation. And vice versa: for low Q systems where bigger tuning changes would not cause large detection losses or for the systems with rapid and frequent conditions changes the threshold setting could be set higher to reduce the unnecessary Dynamic Tuning activity. The threshold value should not be set too low to ensure stable Dynamic Tuning operation.

Fine-tuning the Transceiver

Each transceiver undergoes a thorough optimization and testing process at the factory and is ready for operation right out of the box. But sometimes, depending on the installation environment and the properties of the antenna and antenna cable, the transceiver might require slight adjustments for the best performance.

Care should be taken to avoid any injuries or damage to the transceiver. The present settings of all adjustments should be noted and recorded for backup.

The following procedure will help guide **qualified personnel** in the steps necessary to fine-tune an FS2020 Transceiver.

Tools Required

- Nonconductive potentiometer adjustment tool or small flat blade screwdriver.
- Oscilloscope with the voltage probes (if available).

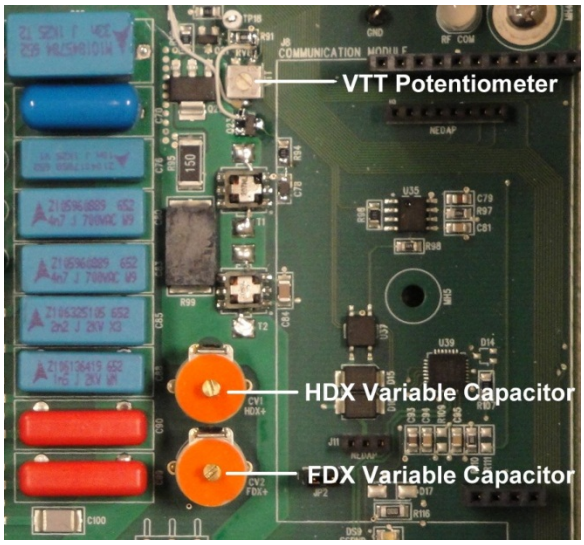
FDX-B Signal Receiver Optimization

To trace the progress of this procedure a real FDX-B tag or a Virtual Tag should be used in conjunction with Detection Efficiency Test or audible sound of the buzzer.

For more information about the Detection Efficiency Test see page 30.

1. **If a real FDX-B tag is used:**
   - Enable the Detection Efficiency Test by selecting **Setup > Detection > Det. Efficiency Test = On.** Return to the main menu and note the test results.
   - Place the tag in the antenna field and slowly move it away until the detection rate is reduced to approximately one or two reads per second.

   If the Virtual Tag is used:
   - Enable the virtual test tag by selecting **Setup > Detection > Virtual Tag Test = On**. Detection efficiency test is enabled automatically at the same time. Return to main menu and note the test results.
   - Adjust the VTT potentiometer RV8 on the Mother Board to reduce the virtual tag signal level until the detection rate is reduced to approximately one or two reads per second.
2. Fine-tune the receiver by adjusting the FDX variable capacitor CV2 on the Mother Board to improve the detection rate (more reads per second).

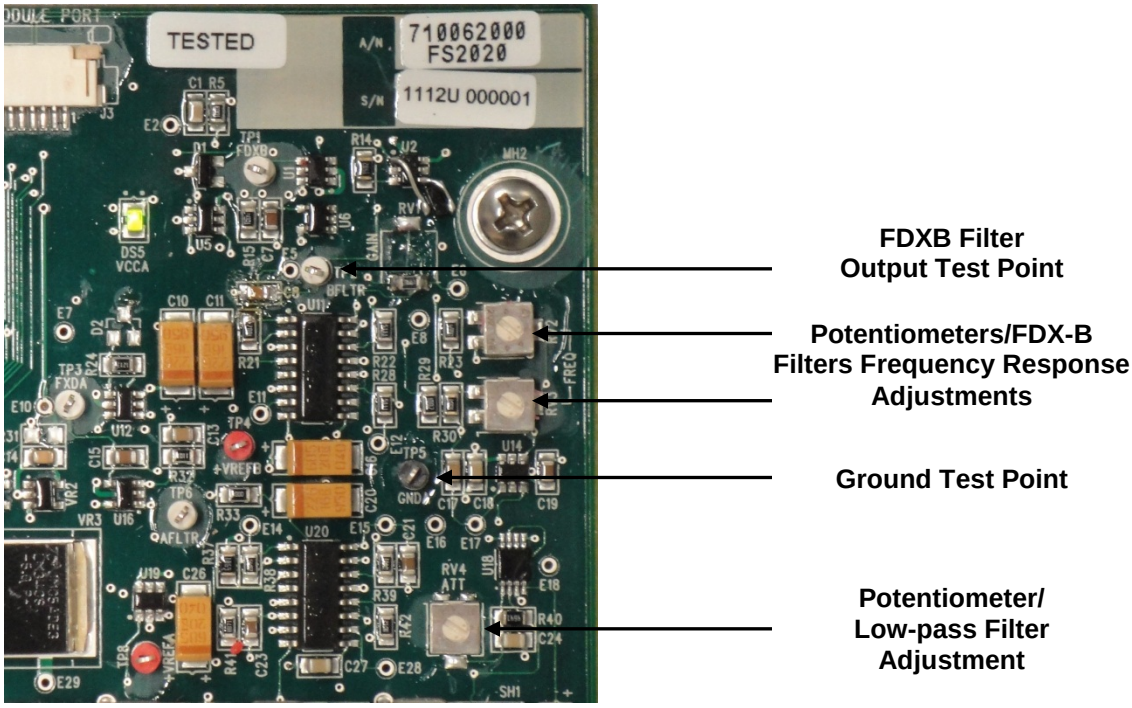


3. Optimize the frequency response of the FDX-B filters by adjusting the two frequency potentiometers RV2 and RV3. These potentiometers are used to equalize the amplitudes of the 2 KHz and 4 KHz signals:

    a. If available, attach an oscilloscope voltage probe to the filter output BFLTR test point TP2 on the Mother Board. The oscilloscope channel needs to be AC coupled. Adjust the scope time domain so that the signal waveform can be viewed clearly (0.5 msec/div).

    b. Adjust potentiometers RV2 and RV3 one-by-one to improve the detection rate and to improve the signal shape.

    c. After this adjustment, the detection at short distances needs to be verified by putting a tag as close as possible to the antenna coil or by increasing the Virtual Tag level to the maximum (turn RV8 all the way clockwise). Make sure there is no interruption in the detection and that the signal shape is not distorted.



4. Repeat Steps 2 and 3 while moving the tag further away from the antenna or by reducing the Virtual Tag level until no improvement to the detection rate can be achieved.
5. Run the Antenna Full Tune process by selecting **Setup > Antenna > Antenna Full Tune**.
6. Sometimes better performance can be achieved when the antenna is slightly de-tuned by manually changing the Antenna Dynamic Tuning Target Phase value. This is done by selecting **Setup > Antenna > Tuning Target Phase**. Adjust the target phase value in small increments by up to 50 points total in both directions to improve detection rate and increase the read range.
7. Adjust potentiometer RV4 to improve the detection rate and to improve the signal shape.
8. Repeat steps 1 through 7 to verify the improvements and to possibly gain more.

HDX Signal Receiver Optimization

To trace the progress of this procedure a real HDX tag must be used in conjunction with the Detection Efficiency Test or with the audible sound of the buzzer.

1. Enable HDX detection by selecting **Setup > Detection > HDX Detection = On.**
2. Enable the Detection Efficiency Test by selecting **Setup > Detection > Det. Efficiency Test = On.**

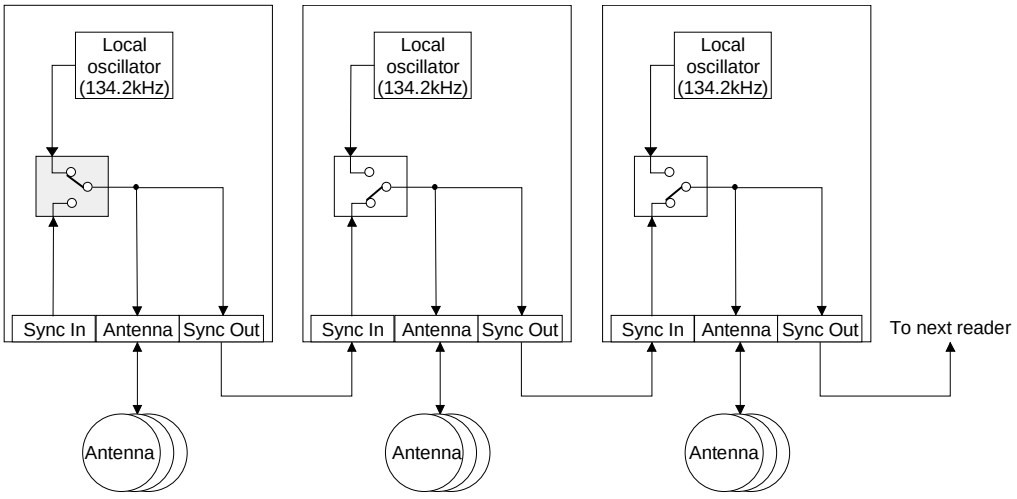
   Return to main menu and note the test results.
3. Place the tag in the antenna field and slowly move it away until the detection rate is reduced to approximately one or two reads per second.
4. Fine-tune the receiver by adjusting the HDX variable capacitor CV1 on the Mother Board to improve detection rate (more reads per second).

Repeat steps 3 and 4 until no further improvement to the detection rate can be achieved.

Synchronizing Multiple Transceivers

If your location contains more than one antenna/transceiver combination, and if the antennas are located in close proximity to one another, you will likely have to synchronize the transceivers in order to avoid antenna phase and noise issues. This section explains why it is necessary to synchronize the transceivers, shows how to cable the transceivers together, and describes how to configure synchronization parameters on each transceiver.

Synchronization is done by synchronizing the Antenna Exciter clock of each transceiver through hardwired twisted-pair interface. The transceivers are connected in a daisy chain configuration, where the synchronization output (Sync Out Port) is connected to the synchronization input (Sync In Port) of the next reader and synchronization input is connected to the output of the previous reader. The first transceiver does not require the synchronization input as it is the source of the synchronization signal. The last transceiver does not have anything connected to its output. Synchronization input signal is used by each transceiver's Antenna Exciter and also is passed through to the synchronization output.



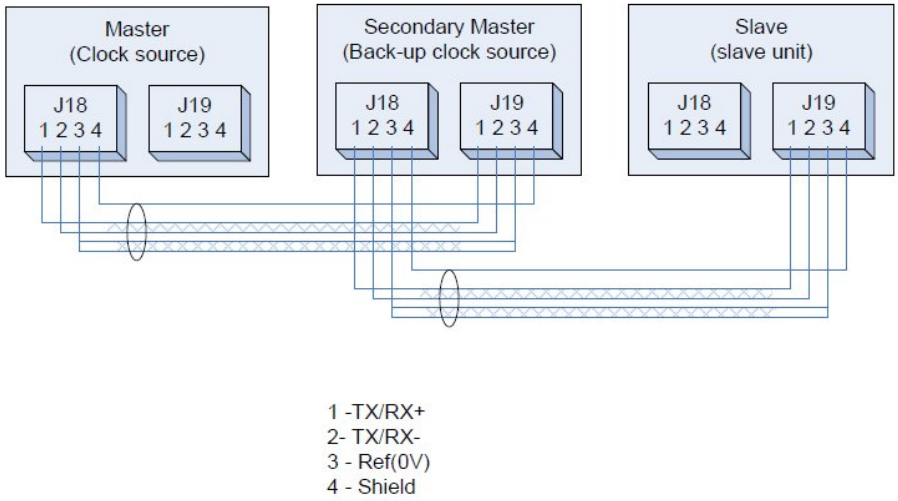
Synchronization network

Use a 4-conductor, two twisted pairs, 18-22AWG wire, shielded cable:

- Use the conductors of one pair to connect TX + to RX + and TX - to RX -
- Use the conductors of the second pair as the signal reference connection

- Use the cable shield drain wire to connect to the shield pins

If using a single twisted pair, 18-22AWG wire, shielded cable, a cable shield drain wire should be used as a signal reference conductor.



Synchronization Wiring Diagram

Master/Slave Concept

Each transceiver can be configured to operate in one of the four synchronization modes that will define this unit's role in the chain and its behavior:

- **Master Mode:** The transceiver uses its own Antenna Exciter clock as the source of the synchronization signal and transmits it to its synchronization output. Synchronization input is disabled. If the unit is put in standby mode its synchronization output signal is disabled. The first transceiver in the chain must be configured as a Master.
- **Slave Mode:** The transceiver uses the synchronization input signal for its Antenna Exciter and also transmits it to its output. The synchronization output signal is still enabled if the transceiver is put in standby mode. If the synchronization input is not present its Antenna Exciter and synchronization output are disabled.
- **Secondary Master Mode:** If the transceiver detects a synchronization signal on its input it acts as a Slave. It uses the input signal for its Antenna Exciter and also transmits it to its output, even when put in standby mode. If the synchronization input is not present the transceiver acts as a Master and uses its own Antenna Exciter clock as the source of the synchronization signal and transmits it to its synchronization output. If the unit is put in standby mode its synchronization output signal is disabled. If at any point the synchronization signal is detected on its input, the transceiver will switch back to being a Slave. This mode should be selected for transceivers dedicated as synchronization signal back up source.
- **Standalone Mode:** The transceiver uses its own Antenna Exciter clock; its synchronization input and output are disabled.

How to Configure the Transceivers for Sync Mode

1. Configure the first transceiver in the chain as the master

   Setup > Reader > Sync Mode = Master

2. Configure all other transceivers in the chain as secondary masters or slaves

   Setup > Reader > Sync Mode = Sec. Master or **Slave**

If the Synchronization Signal is Lost

If the synchronization signal is lost, any transceiver that is set as a secondary master will attempt to assume the master role. To prevent multiple transceivers from becoming the master, each secondary master will continually monitor for a synchronization input signal from an upstream transceiver. If a transceiver receives a synchronization input signal it will stop attempting to assume the master role and will revert to its slave role. So the secondary master that is first in line (furthest upstream in the chain) will ultimately assume the role of the master.

Understanding the Main Menu

When you power on the transceiver the main menu is displayed.

There are three primary areas on the main menu.

- The top row is a status bar that displays a number of status indicators.
  - The first field displays the antenna current in Ampers peak-to-peak.
  - The second field is a dual-use field. If a tag is present it displays the signal strength of the tag. If a tag is not present it displays the signal noise level of the antenna.
  - The third field displays the detected tag ID count. This figure represents the total number of tag IDs that were detected by the transceiver since the last reset of the detection counter (via the Power/Reset key or via **Setup > Detection > Tag Counter > Reset**).

  The status bar will also flash “ALARMS” if any alarms are presently active.
- The large middle area displays information about the last tag detected by the reader. The first line displays the manufacturer ID or country code of the tag. The second line displays the unique tag ID.

  This area will also display the transceiver operating mode percent and the results of the detection efficiency test (if enabled).

Main Menu in Scan Mode

Main Menu in Standby Mode

- The bottom row contains the following keys:
  - **Status:** Used to access the Status menus. See page 23.
  - **Setup:** Used to access the Setup menus. See page 27.
  - **Scan / Stby:** Toggles the transceiver between Scan mode and Standby mode. When in Standby mode, the antenna exciter is disabled.

How To Scan For Tags

The transceiver automatically starts in Scan mode after a power on or a reset and will immediately begin scanning for tags.

Where detected tags are stored and where they are sent depends on how the transceiver is configured.

- All new tag IDs will be stored in memory (this is not configurable).
- Virtual test tag IDs will be stored in memory if **Setup > Memory > Store Virtual Tag = On**.
- New tag IDs will be automatically sent to the remote communication ports (Ethernet and fiber optic).
- New tag IDs may be sent to the USB port if **Setup > Communication > Send Tags to Local Port = On** (see page 29).
- Duplicate tag IDs (the same tag ID detected several times) may or may not be recorded depending on how **Setup > Detection > Unique Mode** is configured (see page 30).

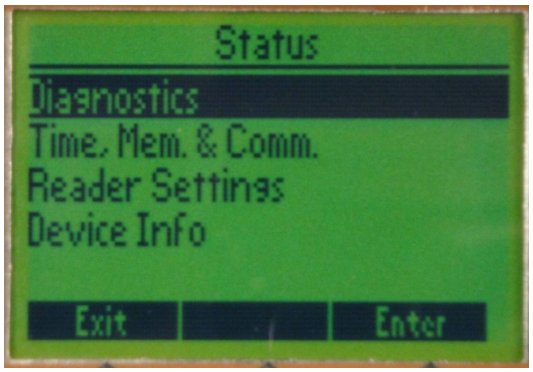
How to View and Capture Detected Tags

- To view the number of tags that have been detected by the transceiver, see the top-right field on the main menu.
- To view the number of tags stored in memory, select **Status > Time, Mem. & Comm. > Stored Tag Count**.
- Detected tag IDs are always sent to the remote ports (Ethernet and Fiber Optic). Any communications program that is monitoring these ports will receive the tag data. See page 43 for information on using the remote ports.
- Detected tag IDs can optionally be sent to the local USB port if **Setup > Communication > Send Tags to Local Port = On**. Any communications program that is monitoring this port will receive the tag data. See page 42 for information on using the USB port.
- To download tag IDs that are stored in memory, select **Setup > Memory > Download Memory**. Any communications program that is monitoring the remote ports (Ethernet and Fiber Optic) will receive the tag data. The tags will also be downloaded to the local port if **Setup > Communication > Send Tags to Local Port = On**.

Status Menu

Pressing the Status Key on the main menu displays the Status menu. The Status menu contains four sub-menu items:

- Diagnostics
- Time, Mem. & Comm. (see page 24)
- Reader Settings (see page 25)
- Device Info (see page 26)



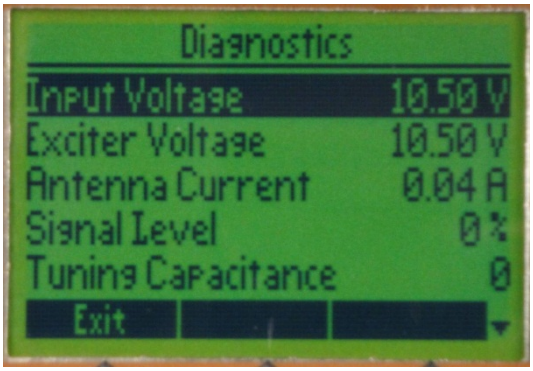
Status Menu with Diagnostics Highlighted

Diagnostics Menu

Press the **Status** key on the main menu and then select **Diagnostics**.

Available information:

- **Input Voltage:** Displays the present input voltage, in volts.
- **Exciter Voltage:** Displays the antenna exciter voltage, in volts.
- **Antenna Current:** Displays the present antenna current, in amperes peak-to-peak.
- **Signal Level:** Displays the present FDXB signal level (0 – 100%).
- **Tuning Capacitance:** Displays the present dynamic tuning capacitance setting. Valid values are 0 – 63.
- **Tuning Relative Phase:** Displays the present antenna tuning target phase minus the present measured phase.
- **Reader Temperature:** Displays the present internal temperature of the transceiver, in degrees Celcius.
- **Backup Battery:** Displays the present status of the backup battery, in Volts. The battery protects the internal clock and memory data.
- **Virtual Tag Level:** Displays the present virtual tag potentiometer setting (0 – 100%).
- **Alarms:** Displays the list of all currently active alarms.



Diagnostics Menu

Time, Memory & Communication Menu

Press the **Status** key on the main menu and then select **Time, Mem. & Comm.**

Available information:

- **Reader Date:** Displays the present date using a mm/dd/yyyy format.

  To change this setting: *Setup* > *Reader* > *System Date*.

- **Reader Time:** Displays the present time using a hh:mm:ss format.

  To change this setting: *Setup* > *Reader* > *System Time*.

- **Stored Tags Count:** Displays the number of tag IDs currently stored in memory.

  To download or erase memory: *Setup* > *Memory*.

- **Free Memory:** Displays the percentage of available tag ID memory space. If memory becomes completely full the oldest tag will be overwritten by the new tag.

  To download or erase memory: *Setup* > *Memory*.

- **Remote Port Protocol:** Displays the communication protocol being used on the remote port (ASCII or BPA).

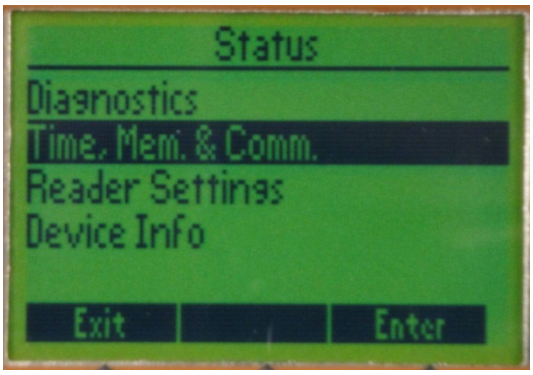
  To change this setting: *Setup* > *Communication* > *Remote Port Protocol*.

- **Local Port Speed:** Displays the speed setting of the local communication port.

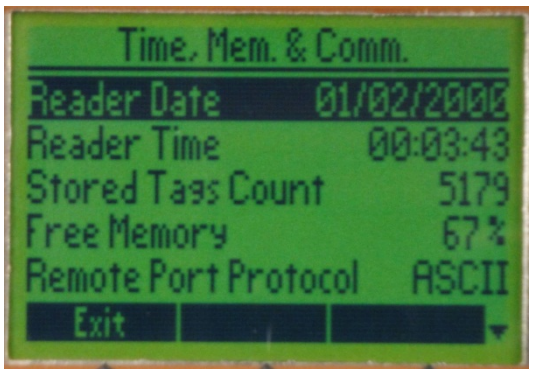
  To change this setting: *Setup* > *Communication* > *Local Port Speed*.

- **Tag ID Display Format:** Displays the format to use when displaying tag IDs (hexadecimal or decimal).

  To change this setting: *Setup* > *Reader* > *Tag Display Format*.



Status Menu with Time, Mem, & Comm. Highlighted



Time, Mem. & Comm. Menu

Reader Settings Menu

Press the **Status** key on the main menu and then select **Reader Settings**.

Available information:

- **Reader ID:** Displays the hexadecimal ID of this transceiver.

  To change this setting: *Setup* > *Reader* > *Reader ID*.

- **Antenna Q:** Displays the antenna quality factor setting (Low or High).

  To change this setting: *Setup* > *Antenna* > *Antenna Q*.

- **Reader Initiation Delay:** Displays if the transceiver is configured to delay transmission of all automatic diagnostics. The delay is computed by multiplying the Reader ID by 1 second.

  To change this setting: *Setup* > *Reader* > *Reader Initiation Delay*.

- **Sync Mode:** Displays the present synchronous mode setting (Master, Sec Master, Slave, or Standalone). For detailed information on synchronizing multiple transceivers, see page 18.

  To change this setting: *Setup* > *Reader* > *Sync Mode*.

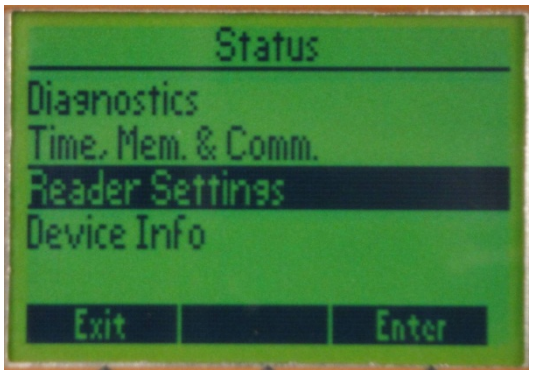
- **Sync Signal:** Indicates if a cable is connected to the *Sync In* port and a synchronization signal is present.

- **FDXB Det. Sensitivity:** Displays the present sensitivity (range) setting.

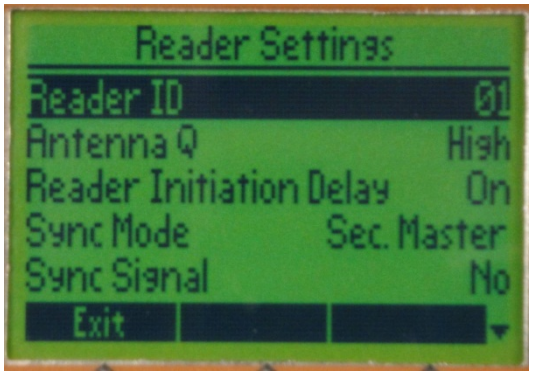
  To change this setting: *Setup* > *Detection* > *FDXB Det. Sensitivity.*

- **HDX Detection:** Displays the present HDX detection setting (On or Off)

  To change this setting: *Setup* > *Detection* > *HDX Detection.*



Status Menu with Reader Settings Highlighted



Reader Settings Menu

- **Detection Unique Mode:** Displays the present detection unique mode setting (Last 1, Last 5, Delay, or Off).

  To change this setting: *Setup* > *Detection* > *Det. Unique Mode.*

- **Detection Unique Delay:** Displays the number of minutes to delay the reporting of unique tags.

  To change this setting: *Setup* > *Detection* > *Det. Unique Delay.*

- **Dynamic Tuning:** Displays the present antenna dynamic tuning setting (On or Off).

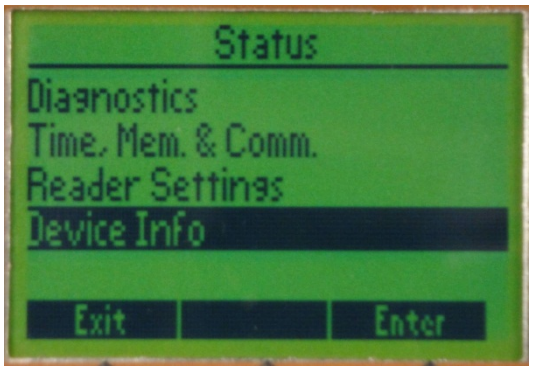
  To change this setting: *Setup* > *Antenna* > *Dynamic Tuning.*

Device Info Menu

Press the **Status** key on the main menu and then select **Device Info**.

Available information:

- **Reader SN:** Displays the Reader serial number.
- **Application Version:** Displays the present application firmware version.
- **Boot Version:** Displays the boot up firmware version.
- **CPLD Version:** Displays the CPU CPLD (Complex Programmable Logic Device) firmware version.
- **DSP Version:** Displays the DSP (Digital Signal Processing) firmware version.



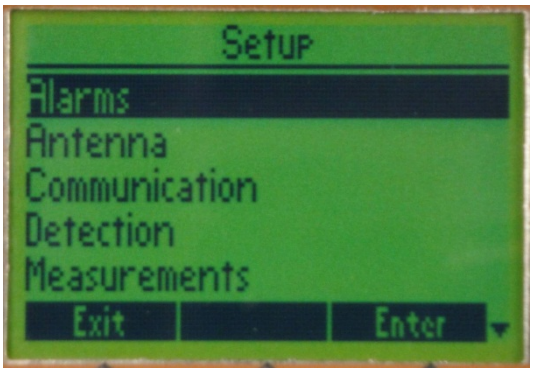
Status Menu with Device Info Highlighted

Device Info Menu

Setup Menu

Pressing the Setup key on the Main menu displays the Setup menu. The Setup menu contains eight sub-menu items:

- Alarms
- Antenna (see page 28)
- Communication (see page 29)
- Detection (see page 30)
- Measurements (see page 32)
- Memory (see page 33)
- Reader (see page 34)
- Reports (see page 35)



Setup Menu with Alarms Highlighted

Alarms Menu

Press the **Setup** key on the main menu and then select **Alarms**.

Available parameters:

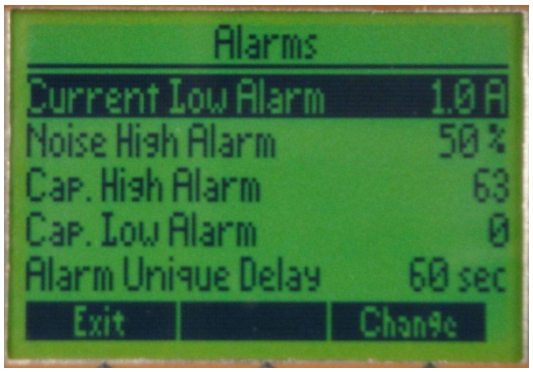
- **Current Low Alarm:** Used to set the low antenna current alarm threshold. Valid values are 0.0A to 10.0A. Default is 1.0A.

  A low antenna current may be caused by an out-of-tune antenna, a bad antenna or antenna connection, reader failure, or an improper threshold setting.

- **Noise High Alarm:** Used to set the excessive noise level alarm threshold. Valid values are 0 to 100%. Default is 50%.

  A high noise level may indicate reader deterioration (tuning or connection problem, etc.)

- **Cap. High Alarm:** Used to set the tuning capacitance high alarm. If the transceiver dynamic tuning capacitors setting becomes equal to or greater than this limit, an alarm will be sent. Valid values are 32 – 63. Default is 63.



Alarms Menu

- **Cap. Low Alarm:** Used to set the tuning capacitance low alarm. If the transceiver dynamic tuning capacitors setting becomes equal to or lower than this limit, an alarm is sent. Valid values are 0 – 31. Default is 0.

- **Alarm Unique Delay:** Used to set the alarm unique delay. Valid values are 0 – 3600 seconds.

  This specifies how long to wait before rebroadcasting a persistent alarm. For example, if Alarm Unique Delay = 60 and the capacitance low alarm is triggered, the transceiver will wait 60 seconds before resending the alarm. If the alarm condition clears and then reappears, the new alarm will be sent without delay.

  Note: The Virtual Tag Test Failed alarm is the exception and will not be rebroadcast.

Antenna Menu

Press the **Setup** key on the main menu and then select **Antenna**.

To change an option, select it and then press **Change**.

Available parameters:

- **Antenna Q:** Used to set the antenna quality factor. Valid values are Low or High. Default is High.

  Switching to Low will significantly reduce the output power of the antenna. This may be desirable if you are using a small antenna and you want to reduce the number of tag collisions due to fish grouping.

  Note: For users of older model transceivers, Low is equivalent to juvenile mode and High is equivalent to adult mode.

- **Dynamic Tuning:** Used to set antenna dynamic tuning to either On or Off. Default is On.

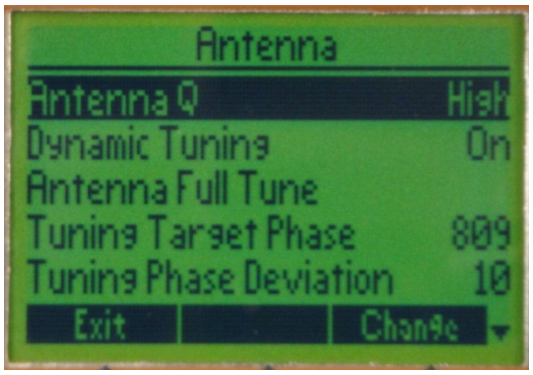
  Dynamic Tuning automatically adjusts the tuning capacitor settings to achieve the desired target phase value.

- **Antenna Full Tune:** Used to initiate a full auto-tuning process of the antenna. It is used to determine the optimum tuning parameters. The process is as follows:

  1. Checks if the antenna is present.
  2. Performs a quick tune.
  3. Performs a full tune by going thru all 64 possible electronically selectable capacitor setting combinations to find the maximum antenna current value. The corresponding phase value becomes the target phase value.

  The full auto-tuning process will typically take less than 10 seconds to complete.

- **Tuning Target Phase:** Used to set or adjust the tuning target phase. Valid values are 0 – 1023.



Antenna Menu

- **Tuning Phase Deviation:** Used to set the tuning phase deviation threshold. Valid deviation values are 1 – 100. Default is 10.

  This specifies how far the actual antenna signal phase can deviate from the target phase before the transceiver begins the dynamic auto-tune process. During this process the transceiver adjusts capacitance in an effort to return to the target phase.

  Note: In low Q systems you might set the Tuning Phase Deviation rather high (40 – 50). In high Q systems requiring more finely tuned antennas you might set the deviation rather low (5 – 10). But beware of setting the deviation value so high that the transceiver is not making any adjustments or so low that the transceiver is not able to maintain the tune point.

- **Tuning Capacitance:** Used to set the specific antenna tuning capacitance level. Valid values are 0 – 63.

Communication Menu

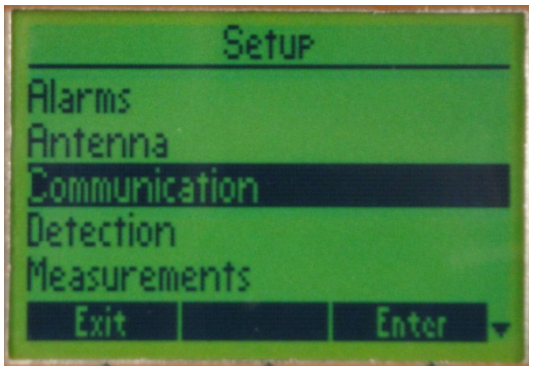
Press the **Setup** key on the main menu and then select **Communication**.

To change an option, select it and then press **Change**.

Available options:

- **Remote Port Protocol:** Sets the protocol used on the remote communication ports (Ethernet and fiber optic). Valid options are ASCII or BPA (Bonneville Power Administration). Default is BPA.
- **Local Port Speed:** Sets the speed used on the local USB communications port. Valid options are 9600, 19200, 38400, 57600, or 115200. Default is 115200 Bd/s.

  Note: Because the transceiver sends data to both the local port and the remote port at the same speed, lowering the local port speed will affect the data output speed on the remote port. The recommendation is to use the highest speed possible.
- **Send Alarms to Local Port:** Specifies if alarms are sent to the local USB port. Valid options are either On or Off. Default is Off.
- **Send Tags to Local Port:** Specifies if detected tag IDs sent to the local USB port. Valid options are either On or Off. Default is Off.



Setup Menu with Communication Highlighted

Communication Menu

Detection Menu

Press the **Setup** key on the main menu and then select **Detection**.

To change an option, select it and then press **Change**.

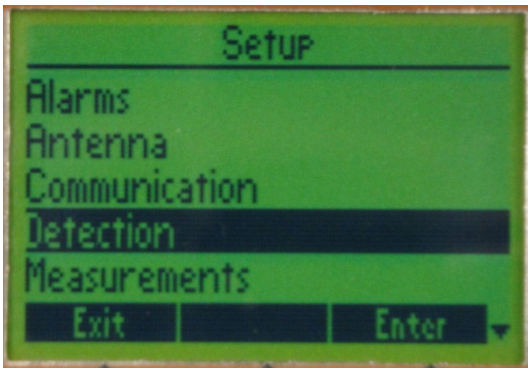
Available options:

- **FDXB Det. Sensitivity:** Adjusts the range at which FDXB tags are detected. Valid values are 20 – 100%. Default is 100%.
- **HDX Detection:** Specifies if half duplex detection is enabled. HDX tags will not be detected if this option is disabled. Valid values are On and Off. Default is Off.
- **Tag Counter:** Specifies if you want the transceiver to keep a running count of the tags it detects. Valid values are On, Off, and Reset. Default is On.

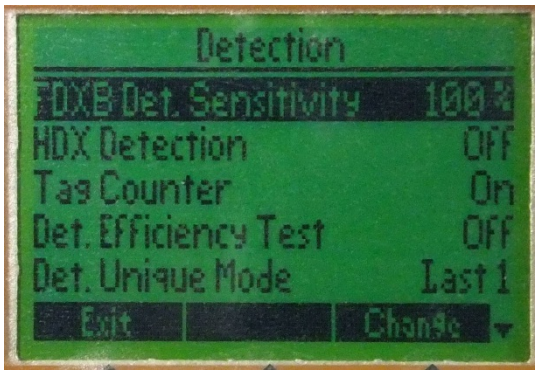
  The tag counter counts all detected tag IDs regardless of the Unique Mode setting.
- **Det. Efficiency Test:** Enables the detection efficiency test. This is used to qualify the performance of the entire system. Valid values are On and Off. Default is Off.

  Efficiency is calculated as a percentage of the number of detections vs. the maximum possible over two second intervals. This test will work with physical tags and with virtual test tags.

  Note: This parameter will be automatically changed to On whenever **Setup > Detection > Virtual Test Tag = On**.
- **Det. Unique Mode:** Specifies how the tag ID is handled if it is detected multiple times. Valid values are:
  - **Last 1:** Tag ID is sent to communication ports accompanied by buzzer sound (if enabled) and stored in memory only if it is different from the previously detected tag ID. This is the default value.



Setup Menu with Detection Highlighted



Detection Menu

  - **Last 5:** Tag ID is sent to communication ports accompanied by buzzer sound (if enabled) and stored in memory only if it is different from the previous five detected dissimilar tag IDs.
  - **Delay:** Tag ID is sent to communication ports accompanied by buzzer sound (if enabled) and stored in memory only if the specified number of minutes have passed since it was first detected or if it is different from the previous five detected dissimilar tag IDs. Use either the **Set delay** key or **Det. Unique Delay** to specify the delay value.
  - **Off:** Disables unique mode. All tag IDs are sent to communication ports accompanied by buzzer sound (if enabled) and stored in memory.

Note: Tag Detected LED flashes and tag ID is displayed on LCD every time

a tag is detected regardless of Det. Unique Mode setting.

- **Det. Unique Delay:** Specifies the delay value for Unique Mode Delay. Valid values are 1 – 1440 minutes. Default is 1 minute.

  Note: In order for Det. Unique Delay to be active Det. Unique Mode must be set to **Delay**. When Det. Unique Mode is set to **Last 1** or **Last 5** Det. Unique Delay function is disabled.

- **Virtual Test Tag:** The Virtual Test Tag (VTT) is a feature designed to verify the transceiver's integrity and sensitivity. It generates an ISO FDX-B tag signal at selectable signal levels and can be activated in the following manner:

  - Automatically if **Auto. VTT Delay** is set to a non-zero value. The test is performed at user-selectable intervals.
  - Manually if **Virtual Test Tag = Single Shot**. The test is initiated for 100 milliseconds.
  - Manually if **Virtual Test Tag = On**. The test is initiated continuously and works in conjunction with detection efficiency test. Detection Efficiency Test is activated automatically when **Virtual Test Tag = On**.

- **Auto. VTT Delay:** Used to set the automatic virtual test tag single shot activation delay. The delay can be set from 0 (disabled) to 1440 minutes (24 hours). When the delay expires, if a real PIT tag is not present in the FS2020 antenna field then the virtual test tag will be activated for 100 milliseconds. This test is done in order to verify that the reader is operating properly especially during extended periods when no PIT tags are present.

Measurements Menu

Press the **Setup** key on the main screen and then select **Measurements**.

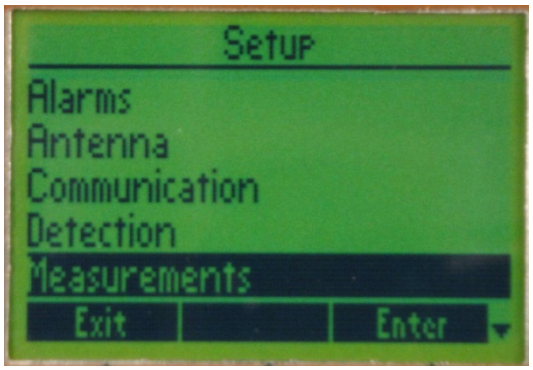
To change an option, select it and then press **Change**.

Available options:

- **Current Gain:** Used to set the antenna current measurement gain. This value is used to calibrate the antenna current peak-to-peak measurement. Valid values are 1 – 400000. Default is 1700.
- **Current Offset:** Used to set the antenna current measurement offset. Valid values are from -400000 to 400000. Default is 50.
- **Noise Gain:** Used to set the noise gain or a tag signal measurement gain. This value is used to calibrate noise level or tag signal level measurement. Valid values are 1 – 10,000. Default is 3000.

  Noise measurement corresponds to peak-to-peak value of a signal at FDX-B receiver output on the Mother Board, meaning that if signal is 5V peak-to-peak (maximum possible), noise level measurement should be 100%. If the output signal is 200mV peak-to-peak, noise level measurement should be 4%.

  If a real tag is present the measurement is treated as the tag signal level.



Setup Menu with Measurements Highlighted

Measurements Menu

Memory Menu

Press the **Setup** key on the main screen and then select **Memory**.

To change an option, select it and then press **Change**.

Available options:

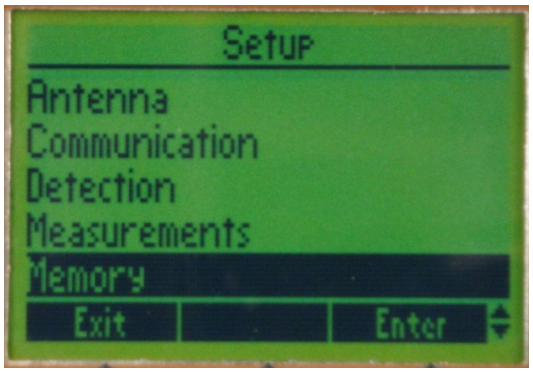
- **Download Memory:** Initiates the download of all tag IDs and short status reports contained in the transceiver's memory. Tag data is sent to the remote ports (Ethernet and fiber optic) and will also be sent to the local port (USB) if **Setup > Communication > Send Tags to Local Port = On**.

  The transceiver memory is NOT erased during the download process.

- **Erase Memory:** Permanently erases all tag IDs and short status reports contained in the transceiver's memory. A warnng message is displayed asking you to confirm this action.

  The recommendation is to download the contents of memory to another computer or storage device before erasing memory.

- **Store Virtual Tag:** Specifies if virtual test tag IDs will be stored in memory. Valid values are On and Off. Default is On.



Setup Menu with Memory Highlighted

Memory Menu

Reader Menu

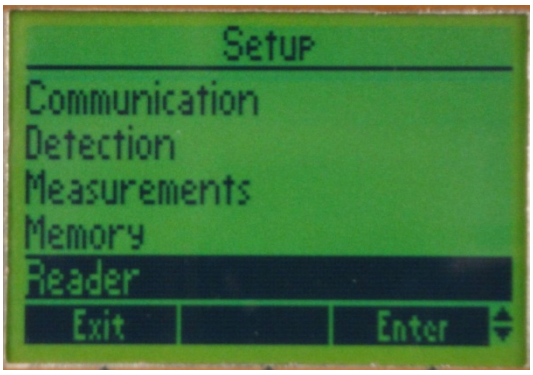
Press the **Setup** key on the main screen and then select **Reader**.

To change an option, select it and then press **Change**.

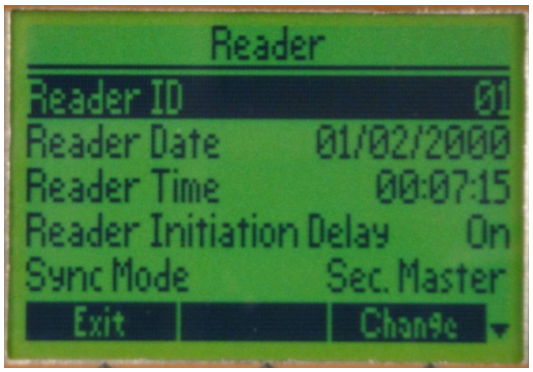
Available options:

- **Reader ID:** Sets the unique ID for this transceiver. The ID is a hexadecimal value in the range 00 – FF. Default is 01.
- **Reader Date:** Sets the present date. The date is specified as mm/dd/yyyy.
- **Reader Time:** Sets the present time. The time is specified using a hh:mm:ss (24 hour) format.
- **Reader Initiation Delay:** Specifies if the transceiver will delay all automatic diagnostics (such as status report, noise report, and VTT) at startup time. All other functionalities, including tag detection, are not delayed. Valid values are On and Off. Default is On.

  The delay time is calculated by multiplying the Reader ID by 1 second.
- **Sync Mode:** Sets the transceiver synchronization mode. Valid values are Master, Sec. Master, Slave, and Stand Alone. Default is Sec. Master. See page 18 for details on multiple reader configurations.
- **Tag ID Display Format:** Specifies the format to use when displaying detected tag IDs. Valid values are Decimal and Hexadecimal. Default is Hexadecimal.
- **Reader Beeper:** Specifies if the transceiver will issue an audible beep when a tag is detected. Valid values are On and Off. Default is Off.
- **Display Backlight:** Specifies if the transceiver's backlight will be used. Valid values are On, Off, and Saving. When in Saving mode, the backlight will turn off after 10 seconds of inactivity and will turn back on when a tag is detected or when a key is pressed.



Setup Menu with Reader Highlighted



Reader Menu

- **Set Default Parameters:** Resets the Setup paramenters to their default values. A warning message will prompt you to confirm this action.

  This will not clear memory or the detection counter. In addition, the following parameters are excluded:

  - Antenna Q
  - Antenna Dynamic Tuning Target Phase
  - Antenna Dynamic Tuning Phase Deviation Threshold
  - Current Measurement Gain
  - Current Measurement Offset
  - FDXB Det. Sensitivity
  - Noise Measurement Gain
  - Reader ID, Reader Date, Reader Time
  - Reader Initiation Delay
  - Reader Synchronization Mode
  - Remote Communication Port Protocol

Reports Menu

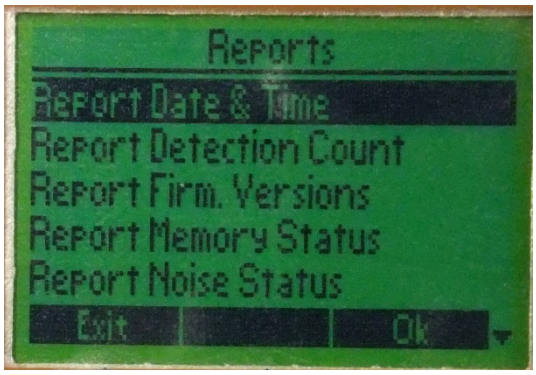
Press the **Setup** key on the main screen and then select **Reports**.

To send a report, select it and then press **Ok**. The report information is sent to the remote ports (Ethernet and fiber optic) and will also be sent to the local port (USB) if **Setup > Communication > Send Tags to Local Port = On**. See pages 42 - 44 for instructions on configuring and using these ports.

All reports can also be generated by issuing commands from a local or remote workstation. See page 48 for details.

Available options:

- **Report Date & Time:** Immediately generates and sends a Date & Time Report. The report contains the present date and time set on the transceiver.
- **Report Detection Count:** Immediately generates and sends a Detection Count Report. The report contains the number of tags detected by the transceiver.
- **Report Firm. Versions:** Immediately generates and sends a Firmware Version Report. The report contains the transceiver serial number and a list of all firmware versions (Boot, Application, CPLDs, and DSP).
- **Report Memory Status:** Immediately generates and sends a Memory Status Report. The report contains the number of tag IDs and the number of short status reports stored in memory and also the amount of available memory.
- **Report Noise Status:** Immediately generates and sends a Noise Status report. The report provides noise statistics such as average and peak noise measurement values.



Reports Menu

- **Noise Report Delay:** Specifies how often to automatically send the Noise Status report. Valid values are 0 (disabled) to 1440 minutes (once every 24 hours). Default is 0.
- **Report Full Status:** Immediately generates and sends a Full Status Report. This report contains vital transceiver configuration settings and diagnostic data.

  See page 51 for details.
- **Status Report Delay:** Specifies how often to automatically send the Full Status report. Valid values are 0 (disabled) to 1440 minutes (once every 24 hours). Default is 180.

  Short versions of automatic status reports (containing critical dynamic diagnostic parameters) are stored in memory (up to 151 reports). The following format is used: fixed-length string of parameters separated by comas, with placeholders for 5 3-letter alarm message codes at the end:

  NNN,param1,param2,param3,…,param16,X,X,X,X,X

  “NNN” – stored status report number

  “X” – placeholder for an alarm message code.

  See page 52 for details.

Menu Structure

Menus and Parameters			
Menu	**Sub Menu**	**Sub Menu**	**Settings**
Status	Diagnostics		Display: Input Voltage Exciter Voltage Antenna Current Signal Level Tuning Capacitance Relative Phase Reader Temperature Backup Battery Virtual Tag Level Alarms
	Time, Mem. & Comm.		Display: Reader Date Reader Time Stored Tags Counter Free Memory Remote Port Protocol Local Port Speed Send Alarms to Local Port Send Tags to Local Port Tag ID Display Format
	Reader Settings		Display: Reader ID Antenna Q Reader Initiation Delay Sync Mode Sync Signal FDXB Det. Sensitivity HDX Detection Detection Unique Mode Detection Unique Delay Dynamic Tuning
	Device Info		Display: Reader SN (Reader Serial Number) Application Version Boot Version CPLD Version DSP Version

Setup	Alarms	Current Low Alarm	Set Current Low Alarm Threshold in Amperes {0.0-10.0} (Default: 1.0)
		Noise High Alarm	Set Noise High Alarm Threshold in Percents {0-100} (Default: 50)
		Cap. High Alarm	Set Tuning Capacitance High Alarm Threshold {32-63} (Default: 63)
		Cap. Low Alarm	Set Tuning Capacitance Low Alarm Threshold {0-31} (Default: 0)
		Alarm Unique Delay	Set Alarms Unique Delay in Seconds {0-3600} (Default: 60)
	Antenna	Antenna Q	Set Antenna Q {L} Low, {H} High (Default: H)
		Dynamic Tuning	Set Antenna Dynamic Tuning {1} On, {0} Off (Default: 1)
		Antenna Full Tune	Perform Antenna Full Tune
		Tuning Target Phase	Set Antenna Dynamic Tuning Target Phase {0-1023}
		Tuning Phase Deviation	Set Antenna Dynamic Tuning Phase Deviation Threshold {0-1023} (Default: 10)
		Tuning Capacitance	Set Antenna Tuning Capacitance {0-63}
	Communication	Remote Port Protocol	Set Remote Communication Port Protocol {A} ASCII, {B} BPA (Default: B)
		Local Port Speed	Set Local Communication Port Speed (Default: 115200)
		Send Alarms to Local Port	Set Alarms Communication to Local Port {1} On, {0} Off (Default: 0)
		Send Tags to Local Port	Set Tags Communication to Local Port {1} On, {0} Off (Default: 0)
	Detection	FDXB Det. Sensitivity	Set FDXB Detection Sensitivity {20-100%} (Default: 100%)
		HDX Detection	Set HDX Detection {1} On, {0} Off (Default: 0)
		Tag Counter	Set Detection Counter {1} On, {0} Off, {R} Reset (Default: 1)
		Det. Efficiency Test	Set Detection Efficiency Test {1} On, {0} Off (Default: 0)
		Det. Unique Mode	Set Detection Unique Mode {5} Last 5, {1} Last 1, {0} Off, {D} Delay (Default: 1)
		Det. Unique Delay	Set Detection Unique Delay in Minutes (Default: 1)

		Virtual Tag Test	Set Detection Virtual Tag Test {1} On, {0} Off, {S} Single-Shot (Default: 0)
		Auto. VTT Delay	Set Automatic Detection Virtual Tag Test Delay in Minutes (Default: 60)
	Measurements	Current Gain	Set Current Measurement Gain (Default: 1700)
		Current Offset	Set Current Measurement Offset (Default: 50)
		Noise Gain	Set Noise Measurement Gain (Default: 900)
	Memory	Download Memory	Download Full Memory
		Erase Memory	Erase Full Memory
		Store Virtual Tag	Save Virtual Tags to Memory {1} On, {0} Off (Default: 1)
	Reader	Reader ID	Set Reader ID in HEX {01-FF} (Default: 01)
		Reader Date	Set Reader Date {MM,DD,YYYY} (Default: 01,01,2010)
		Reader Time	Set Reader Time {HH,MM,SS} (Default: 00,00,00)
		Reader Initiation Delay	Set Reader Initiation Delay {1} On, {0} Off (Default: 1)
		Sync. Mode	Set Reader Synchronization Mode {1} Master, {2} Secondary Master, {3} Slave, {0} Standalone (Default: 2)
		Tag ID Display Format	Set Tag ID Display Format {H} Hex, {D} Dec (Default: H)
		Reader Beeper	Set Reader Beeper {1} On, {0} Off (Default: 1)
		Display Backlight	Set Reader Display Backlight {1} On, {0} Off, {S} Saving (Default: S)
		Set Default Parameters	Reset to Reader Default Parameters
	Reports	Report Date & Time	Send Date and Time Report
		Report Detection Count	Send Detection Counter Report
		Report Firm. Versions	Send Firmware Versions Report
		Report Memory Status	Send Memory Status Report
		Report Noise Status	Send Noise Report

		Noise Report Delay	Set Automatic Noise Report Delay in Minutes {0-1440} (Default: 0)
		Report Full Status	Send Status Report
		Status Report Delay	Set Automatic Status Report Delay in Minutes {0-1440} (Default: 180)

Establishing a Connection with the Transceiver

There are three ways to make a connection with the transceiver:

- **USB port:** Connects the transceiver to a local device such as a laptop. Use this port to monitor, maintain, and program the transceiver while at the local site. Tags detected by the transceiver are sent to this port only if **Setup > Communication > Send Tags to Local Port = On**. This port operates using the ASCII protocol.

  See page 42 for information on using this port.

- **Fiber Optic transmit and receive ports:** Connects the transceiver to a high speed fiber optic network for long distance communication. Use this port to monitor and operate the transceiver from a remote site. Tags detected by the transceiver are automatically sent to this port. This port operates using either the ASCII or BPA protocol.

  See page 43 for information on using these ports.

- **Ethernet port:** Connects the transceiver to a local area network (LAN). Use this port to monitor and operate the transceiver from a remote site. Tags detected by the transceiver are automatically sent to this port. This port operates using either the ASCII or BPA protocol.

  See page 44 for information on using this port.

  Note: Although you can use the Ethernet and fiber optic connections at the same time, the recommendation is to use only one or the other. This will prevent conflicting configuration commands from being sent simultaneously from different sources.

ASCII Protocol

ASCII (American Standard Code for Information Interchange) is a character-encoding scheme based on the ordering of the English alphabet. A string of 7 binary digits represents each character. This is the simplest communications protocol. It transmits only ASCII characters and uses ASCII control codes. It implies little or no error checking. This protocol is supported by the BioTerm communications program developed by Biomark and by most standard communications programs such as Terminal, HyperTerminal, Tera Term Pro, ProComm, PuTTY, etc.

Note: BioTerm is supplied on the USB Flash memory device included with the transceiver.

To help sort the data, all messages have an identifier that defines their type:

- “MSG:” used to define real time informational message.
- “ALM:” used to define real time alarm or error message.
- “TAG:” used to define real time tag ID message.
- “*TAG:” used to define stored in memory tag ID message.

BPA Protocol

BPA (Bonneville Power Administration) protocol is full duplex, asynchronous, byte oriented. No echo is provided on each character. This protocol is supported by the MultiMon or MiniMon software packages developed by the Pacific States Marine Fisheries Commission (PSMFC).

The general format of the messages is as follows:

SOT	Type	Length	Transceiver ID	Message	CRC	Spare	EOT

SOT — Start Of Text ($01), 1 byte. Indicates the start of a message block.

Type — Message type, 1 byte. Indicates the type of information found in the message field. The following message types are supported:

Type (hex)	Definition	Comments
1	Real time ISO tag code, binary encoded	Tag messages
2	Buffered ISO tag code, binary encoded	Type 2 messages are similar to Type 1 except that they are retrieved from the reader buffer. Therefore, they cannot be used by the computers for fish diversion.
3	ASCII text message	Normally used for diagnostics

Length — Message length, 2 byte, MSB first. Indicates the length of the Type 3 ASCII message. This field is not sent for Type 1 and 2 messages. The length of ASCII messages is restricted to 1000 bytes.

Transceiver ID — Address of the transceiver, 1 byte. In a typical installation, each transceiver address is unique. Address $00 is reserved for future use and address $FF is reserved for broadcast messages.

Message — The message field is either the ISO binary tag code for Type 1 and 2 messages (10-bit manufacturer code plus 38 bits National ID code) or the ASCII messages. The tag code is as following (including the manufacturer ID "M" concatenated with the tag number "T", most significant bit left justified, as defined by the ISO FDX-B format, excluding the stuffing bits):

Binary info	MMMMMMMM	MMTTTTTT	TTTTTTTT	TTTTTTTT	TTTTTTTT	TTTTTTTT
Weight	MSB.....	LSB | MSB.....	.....	.....	.....	.....LSB

The length of ASCII messages is restricted to 1000 bytes.

CRC — CRC calculation, 2 bytes. The CRC-CCITT calculation is done over the Message field only. Within the CRC field, the MSB is presented first followed by the LSB.

Spare — Byte reserved for future use.

EOT — End Of Text delimiter, 1 byte ($04). Indicates the end of a message block.

USB Port Operation

The transceiver can be operated and configured locally using the USB port. To establish connection:

1. Install the Silicon Labs CP210x USB to UART Bridge Virtual COM Port (VCP) Windows drivers on the computer used to communicate with the transceiver:

   Note: The drivers installation file is supplied on the USB Flash memory device included with the transceiver. Or to download the latest version follow the link: http://www.silabs.com/products/mcu/pages/usbtouartbridgevcpdrivers.aspx.

2. Connect the transceiver to a local computer using a USB type A to mini USB type B cable (not supplied).
3. Determine the communication port number assigned to the USB port that the transceiver is connected to on the local computer. In BioTerm click “Refresh” button and look for port COM# Silicon Labs CP210x USB to UART Bridge (where # is the port number assigned to the local computer’s USB port).
4. Use a communication program to make a serial port connection to the transceiver.

   BioTerm communications program developed by Biomark or most standard communication programs can be used, including Terminal, HyperTerminal, Tera Term Pro, ProComm, PuTTY, etc.

   Note: BioTerm is supplied on the USB Flash memory device included with the transceiver.

   Configure the communications program serial port settings as follows:

   - *Port* = COM# (port number assigned to the USB port that the transceiver is connected to on the local computer)
   - *Baud rate* = 115200 (match the local port speed setting of the transceiver)
   - *Data bits* = 8
   - *Parity* = None
   - *Stop bits* = 1
   - *Flow control* = None

5. (Optional) To record and store all communication data such as tag IDs, alarm messages, reports, etc., configure the communications program to act as a data logger.
6. Type transceiver commands to perform the desired actions.

   To verify the connection between the computer and the transceiver, type **?** at the communications program and then press **Enter**. If a list of available commands is displayed you know you have a working connection.

   The valid transceiver commands are described on page 48.

Fiber Optic Port Operation

The transceiver can be operated and configured locally using a fiber optic connection. To establish connection:

1. Connect the transceiver to the network using fiber optic cables (not supplied).
2. Determine the communication port number assigned to the port that the fiber optic-to-serial communication converter is connected to on the remote computer.
3. Use a communications program to make a serial port connection to the transceiver.

   When the Remote Port Protocol is set to ASCII, BioTerm communications program developed by Biomark or most standard communications programs can be used, including Terminal, HyperTerminal, Tera Term Pro, ProComm, PuTTY, etc. If the Remote Port Protocol is set to BPA, custom communications program such as MultiMon or MiniMon needs to be used that is designed by the Pacific States Marine Fisheries Commission (PSMFC) specifically for use with the FS2020 Transceivers.

   Note: BioTerm is supplied on the USB Flash memory device included with the transceiver.

   Configure the communications program serial port settings as follows:

   - *Port* = COM# (the port number that the fiber optic-to-serial converter is connected to on the remote computer)
   - *Baud rate* = 115200 (this speed is fixed at the transceiver)
   - *Data bits* = 8
   - *Parity* = None
   - *Stop bits* = 1
   - *Flow control* = None
4. (Optional) To record and store all communication data such as tag IDs, alarm messages, reports, etc., configure the communications program to act as a data logger.
5. Type transceiver commands to perform the desired actions.

   To verify the connection between the computer and the transceiver, type **?** at the communications program and then press **Enter**. If a list of available commands is displayed you know you have a working connection.

   The valid transceiver commands are described on page 48.

Ethernet Port Operation

The transceiver can be monitored and configured remotely across a local area network. To establish connection:

1. Connect the transceiver to your local network using a CAT5 Ethernet cable (not supplied).
2. Determine the transceiver's IP address.

   The transceiver is set to automatically obtain an IP address when it is powered on. The easiest way to discover the assigned IP address is to use BioTerm communications program or Lantronix DeviceInstaller. These applications will scan your network for Lantronix products (the FS2020 Transceiver uses Lantronix XPort Ethernet module) and will display the IP addresses of the devices they find. If there are multiple transceivers on the network use the MAC addresses of the transceiver's Ethernet module to help identify each one.

   Note: BioTerm is supplied on the USB Flash memory device included with the transceiver. DeviceInstaller can be downloaded from Lantronix Web site.

3. Use a communications program to make a connection to the transceiver.

   When the Remote Port Protocol is set to ASCII, BioTerm communications program developed by Biomark or most standard communications programs that support the TCP/IP networking protocol can be used, including Terminal, HyperTerminal, Tera Term Pro, ProComm, PuTTY, etc. If the Remote Port Protocol is set to BPA, custom communications program such as MultiMon or MiniMon needs to be used that is designed by the Pacific States Marine Fisheries Commission (PSMFC) specifically for use with the FS2020 Transceivers. To make a connection with the transceiver, configure the communications program as follows:

   - *Host address* = the transceiver's IP address
   - *Port* = 10001
   - *Connection type* = TCP/IP

4. (Optional) To record and store all communication data such as tag IDs, alarm messages, reports, etc., configure the communications program to act as a data logger.
5. Type transceiver commands to perform the desired actions.

   To verify the connection between the computer and the transceiver, type **?** at the communications program and then press **Enter**. If a list of available commands is displayed you know you have a working connection.

   The valid transceiver commands are described on page 48.

Configuring the Transceiver's Network Settings

Depending on your organization's security policy, it may be required to assign a static IP address to the transceiver. You may also wish to configure certain security settings that dictate who has network access to the transceiver.

One way to accomplish this is by using a Lantronix DeviceInstaller. This application will scan your network for Lantronix products (the FS2020 Transceiver uses Lantronix XPort Ethernet module) and will display the IP addresses of the devices it finds. If there are multiple transceivers on the network use the MAC addresses of the transceiver's Ethernet module to help identify each one.

Note: For additional information see the Lantronix XPort User Guide, available from the Lantronix Web site. DeviceInstaller can be downloaded from Lantronix Web site.

To assign a static IP address to the Transceiver

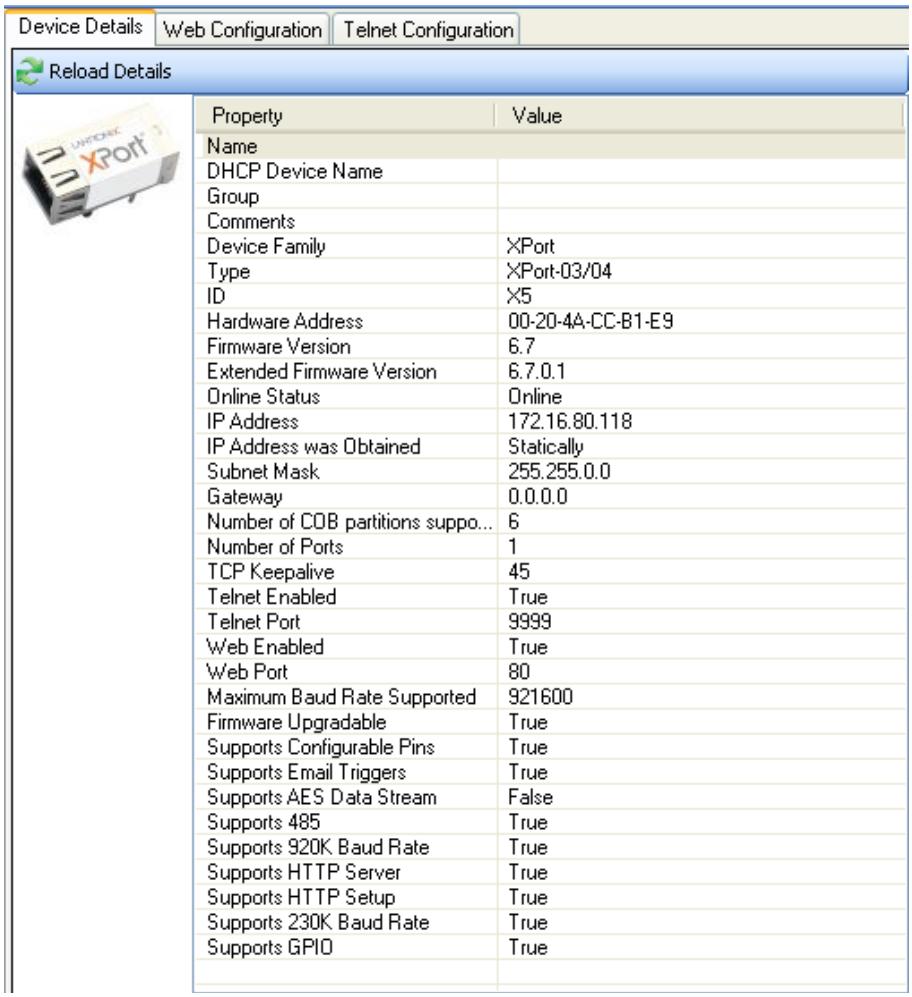
When you first connect the transceiver to your network it will typically be assigned a random IP address based on your network addressing scheme. Depending on your network configuration, this IP address may change each time you power the transceiver off and on. To assign the transceiver a static IP address:

1. Obtain an IP address from your network administrator.
2. Connect the transceiver to your network using the Ethernet port.
3. Within the Lantronix DeviceInstaller, click **Search** to locate the transceiver and identify its present IP address.
4. Click **Assign IP**.
5. Follow the on-screen instructions for assigning a specific IP address.

To configure the Transceiver's network settings

Important! Only experienced and qualified network administrators should attempt to modify any of the transceiver's configuration settings.

1. In the left-hand pane, select the transceiver.

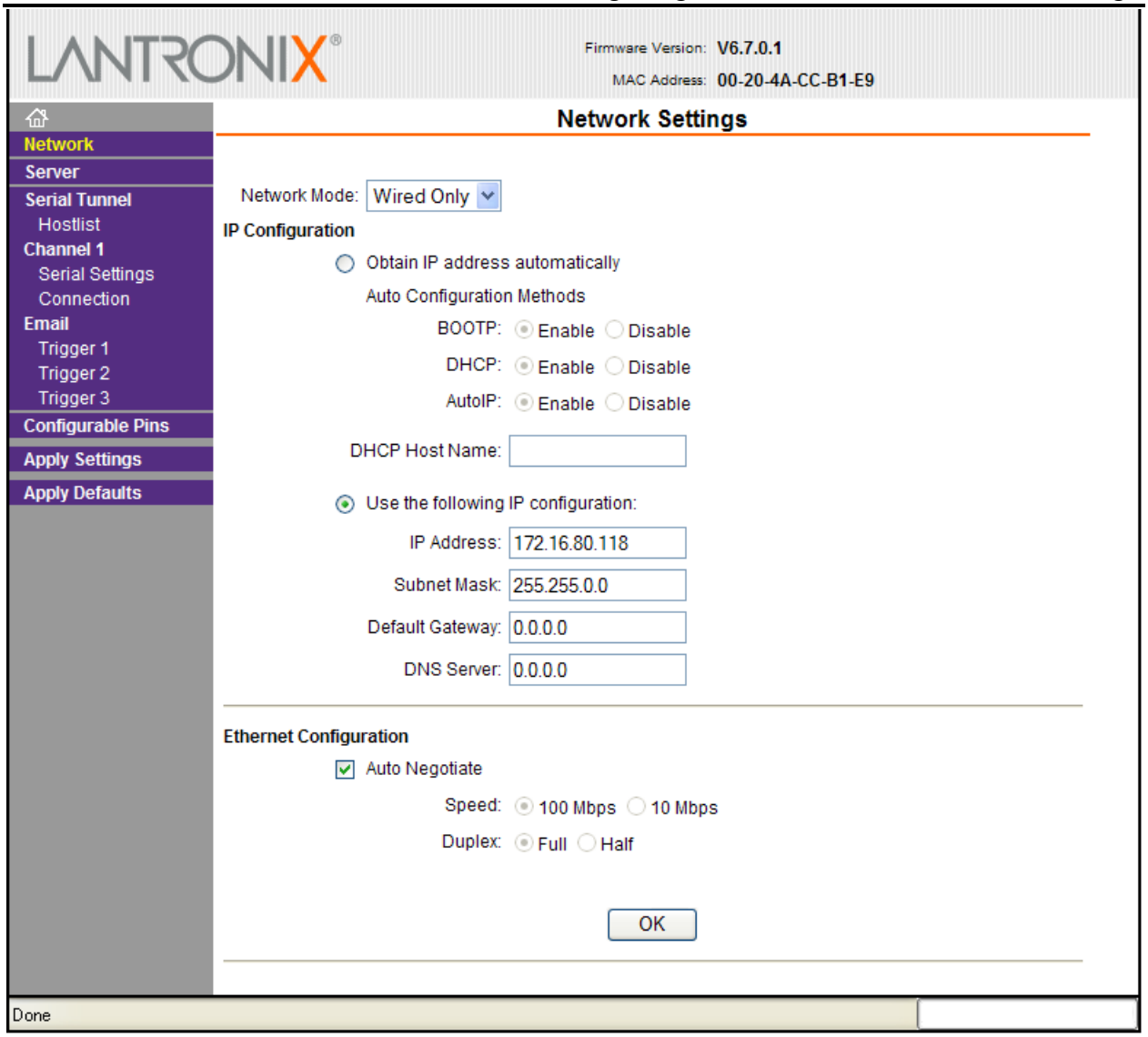


2. In the right-hand pane, select the **Web Configuration** tab.

   The transceiver's IP address is displayed at the top.

3. To the right of the IP address, click the green arrow.

   The transceiver's configurable network settings are displayed within the Lantronix DeviceInstaller browser. For example:



4. Use the browser interface to modify the desired settings.

Important! Do not change the serial settings as they are set to establish communication between the transceiver's Ethernet module and CPU.

Transceiver Commands

The transceiver commands are made of three or more characters followed by a carriage return, as illustrated in the following example:

ACL 1.0↵

Generally, the first three letters designate the command group and the remaining letters/digits designate the command parameters. The commands are not case sensitive. The backspace key can be used to correct an improper command.

The following table is a list of the available commands.

Cmd	Format	Description
?		Display list of available commands
Alarms		
ACL	{0.0-10.0}	Set Current Low Alarm Threshold in Amperes (Default: 1.0)
ANH	{0-100}	Set Noise High Alarm Threshold in Percents (Default: 50)
ATH	{32-63}	Set Tuning Capacitance High Alarm Threshold (Default: 63)
ATL	{0-31}	Set Tuning Capacitance Low Alarm Threshold (Default: 0)
AUD	{0-3600}	Set Alarms Unique Delay in Seconds (Default: 60)
Antenna		
AQS	{L|H}	Set Antenna Q {L} Low, {H} High (Default: H)
ADT	{1|0}	Set Antenna Dynamic Tuning {1} On, {0} Off (Default: 1)
AFT		Perform Antenna Full Tune
ATC	{0-63}	Set Antenna Tuning Capacitance
ATD	{0-100}	Set Antenna Dynamic Tuning Phase Deviation Threshold (Default: 10)
ATP	{0-1023}	Set Antenna Dynamic Tuning Target Phase
Communication		
CPR	{A|B}	Set Remote Communication Port Protocol {A} ASCII, {B} BPA (Default: B)
CSL	{bps}	Set Local Communication Port Speed (Default: 115200)
CAL	{1|0}	Set Alarms Communication to Local Port {1} On, {0} Off (Default: 0)
CTL	{1|0}	Set Tags Communication to Local Port {1} On, {0} Off (Default: 0)

Detection		
DBS	{20-100}	Set FDXB Detection Sensitivity in % (Default 100%)
DCS	{1|0|R}	Set Detection Counter {1} On, {0} Off, {R} Reset (Default: 1)
DET	{1|0}	Set Detection Efficiency Test {1} On, {0} Off (Default: 0)
DHT	{1|0}	Set HDX Detection {1} On, {0} Off (Default: 0)
DUM	{5|1|0|D}	Set Detection Unique Mode {5} Last 5, {1} Last 1, {0} Off, {D} Delay (Default: 1)
DUD	{1-1440}	Set Detection Unique Delay in Minutes (Default: 1)
DTD	{0-1440}	Set Automatic Detection Virtual Tag Test Delay in Minutes (Default: 60)
DVT	{1|0|S}	Set Detection Virtual Tag Test {1} On, {0} Off, {S} Single-Shot (Default: 0)
Measurements		
MCG	{1-400000}	Set Current Measurement Gain (Default: 1700)
MCO	{+/-400000}	Set Current Measurement Offset (Default: 50)
MCR		Report Current Raw Measurement Value
MNG	{1-10000}	Set Noise Measurement Gain (Default: 900)
Memory		
MFD		Download Full Memory
MFE		Erase Full Memory
MVT	{1|0}	Save Virtual Tags to Memory {1} On, {0} Off (Default: 1)
Reader		
RBS	{1|0}	Set Reader Beeper {1} On, {0} Off (Default: 0)
RDS	{MM,DD,YYYY}	Set Reader Date (Default: 01,01,2000)
RDB	{1|0|S}	Set Reader Display Backlight {1} On, {0} Off, {S} Saving (Default: S)
RDF	{H|D}	Set Tag ID Display Format {H} Hexadecimal, {D} Decimal (Default: H)
RDP		Reset to Reader Default Parameters
RIS	{01-FF}	Set Reader ID in HEX (Default: 01)

RID	{1,0}	Set Reader Initiation Delay {1} On, {0} Off (Default: 1)
ROM	{1|0|R}	Set Reader Operation Mode {1} Active, {0} Standby, {R} Reset (Default: 1)
RSM	{1|2|3|0}	Set Reader Synchronization Mode {1} Master, {2} Secondary Master, {3} Slave, {0} Standalone (Default: 2)
RTS	{HH,MM,SS}	Set Reader Time (24-hour) (Default: 00,00,00)
Reports		
RDC		Report Detection Counter
RDT		Report Current Date and Time
RFV		Report Firmware Versions
RMS		Report Memory Status
RNS		Report Noise Status
RND	{0-1440}	Set Automatic Noise Report Delay in Minutes (Default: 0)
RFS		Report Full Status
RSD	{0-1440}	Set Automatic Status Report Delay in Minutes (Default: 180)

Report Structures

Full Status Report Structure

STATUS MESSAGE	MESSAGE INFORMATION
Reader Info:	
Reader SN	Reader Serial Number (RSN)
Reader Date	Reader date
Reader Time	Reader time
Last Shutdown Date	Reader last shutdown date
Last Shutdown Time	Reader last shutdown time
Application Version	Application firmware version
Reader ID	Reader ID setting in HEX (01-FF)
Reader Initiation Delay	Reader automatic diagnostics delay setting (On/Off)
Reader Mode	Reader operation mode (Scan/Standby)
Sync Mode	Sync. mode setting (Master/Secondary Master/Slave/Standalone)
Sync Input	Synchronization signal presence (Yes/No)
Antenna Q	Antenna Q setting (High/Low)
Tag ID Display Format	Tag ID display format setting (Hex/Dec~~imal~~)
Detected Tags	FDXB/HDX
FDXB Sensitivity	FDXB Detection sensitivity setting (High/Low or %)
Det. Unique Mode	Unique mode setting(Last 5/Last 1/Off/Delay)
Det. Unique Delay	Unique Delay value setting
Detection Count	Detected tags count
Store Virtual Tag	Yes/No
Memory Count	Stored tags count
Memory Free	% Of free tag memory
Remote Port Protocol	BPA/ASCII
Local Port Speed	Local port baud rate setting
Local Port Mode	Tags/Alarms/All/None
Reader Beeper	On/Off
Diagnostics Info:	
Reader Temperature (˚C)	Internal reader temperature in degrees Celsius
Backup Battery Voltage (V)	Backup battery voltage in Volts
Input Voltage (V)	Input voltage in Volts
Exciter Voltage (V)	Exciter voltage in Volts
Antenna Current (Ap-p)	Antenna current in Amperes peak-to-peak
Tuning Capacitance	Present tuning capacitance setting (0-63)
Tuning Relative Phase	Antenna tuning target phase minus measured phase
Signal Level (%)	FDX-B signal level (0-100%)
Virtual Tag Level (%)	Virtual tag potentiometer setting (0-100%)

Dynamic Tuning	Antenna dynamic tuning setting (On/Off)
Tuning Target Phase	Antenna dynamic tuning target phase setting
Tuning Phase Deviation Threshold	Antenna dynamic tuning phase deviation threshold setting
Alarm Unique Delay (Sec)	Alarm unique delay setting in second
Auto. VTT Delay (Min)	Automatic virtual tag test delay setting in minutes
Status Report Delay (Min)	Automatic status report delay setting in minutes
Noise Report Delay (Min)	Automatic noise report delay setting in minutes
Current Gain	Current measurement gain setting
Current Offset	Current measurement offset setting
Noise Gain	Noise measurement gain setting
Current Low Alarm Threshold (Ap-p)	Low antenna current alarm threshold setting in Amperes peak-to-peak
Noise High Alarm Threshold (%)	High noise alarm threshold setting (0-100%)
Cap Low Alarm Threshold	Low tuning capacitance alarm threshold setting (0-31)
Cap High Alarm Threshold	High tuning capacitance alarm threshold setting (32-63)
Active Alarms	List of all currently active alarms in abbreviated format

Short Status Report Structure

STATUS MESSAGE	MESSAGE INFORMATION
Report Number	Report number (001-151)
Date	Reader report date
Time	Reader report time
Reader ID	Reader ID setting (01-FF)
Reader Mode	Reader mode (Scan/Standby)
Sync Input	Synchronization signal presence (Yes/No)
Detection Count	Detected tags count
Memory Count	Stored tags count
Memory Free	Free memory (0-100%)
Reader Temperature (˚C)	Internal reader temperature in degrees Celsius
Backup Battery Voltage (V)	Backup battery voltage in Volts
Input Voltage (V)	Input voltage in Volts
Exciter Voltage (V)	Exciter voltage in Volts
Antenna Current (Ap-p)	Antenna current in Amperes peak-to-peak
Tuning Capacitance	Present tuning capacitance setting (0-63)
Tuning Relative Phase	Antenna tuning target phase minus measured phase
Signal Level (%)	FDXB signal level (0-100%)
Active Alarms	List of 5 currently active alarms in abbreviated format

Alarm Messages and Codes

When an abnormal condition is detected by the transceiver it generates an alarm message that is displayed on the LCD screen and is sent to communication ports. The following table is a list of the available alarms and corresponding codes.

Alarm Full Message	Alarm Code	Alarm Description
Antenna Current Low	ACL	Antenna current is below the threshold
Antenna Not Present	ANP	Antenna connection was not detected
Antenna Tuning Failed	ATF	Antenna is out of dynamic tuning range
Tuning Capacitance High	ATH	Dynamic tuning capacitance setting is above the threshold
Tuning Capacitance Low	ATL	Dynamic tuning capacitance setting is below the threshold
Tuning Out of Range	ATO	Dynamic tuning capacitance has reached the physical range limit
Backup Voltage Low	BVL	Backup battery voltage is below 2.0V
DSP Reset	DSP	DSP reset
Exciter Voltage Low	EVL	Exciter voltage is below 8.0V
Input Voltage Low	IVL	Input voltage is below 8.0V
Memory Data Lost	MDL	Unintended memory data loss (as a result of firmware update, backup battery failure, etc.)
Memory Low	MML	Memory is 90% full
Memory Full	MMF	Memory is 100% full
Noise Level High	NLH	FDX-B noise level is above the threshold
Parameters Reset to Factory Default!!!	PAR	Parameters became invalid or corrupted. Unintended reset to factory default values.
Reader Set To Master	RIM	Reader sync. mode is switched to Master (when reader is configured as Secondary Master)
RTC Comm	RTC	Real-Time Clock hardware problem
Reader Temperature High	RTH	Reader temperature is above +70ºC
Reader Temperature Low	RTL	Reader temperature is below -20ºC
Sync. Input Not Present	SNP	Sync. input signal was not detected (when reader is configured as Secondary Master or Slave)
Sync. Parameters Error	SPE	Sync. parameters error
Time and Date Lost	TDL	Time and date reset to default (as a result of backup battery failure, etc.)
Virtual Tag Test Failed	VTF	Virtual tag was not detected

Self-Tests and Diagnostics

The transceiver contains integrated self-test and diagnostics that are used to verify the integrity of the hardware. The following tests can be performed on the transceiver:

- Power-up self-tests are performed each time the transceiver is turned on.

  When the transceiver is turned on it automatically performs a number of tests on its internal components (the initialization firmware, flash memory, RAM memory, lithium battery, etc.). The transceiver will not start unless all tests are successful.

- Start-up diagnostics are performed when the transceiver is successfully powered on:
  - Virtual tag level setting check.
  - Antenna presence check.
  - Antenna tuning check by running the quick-tune process.
  - Sync In signal presence check (for multiple transceiver synchronization configuration).
  - System performance check by activating the virtual tag single shot test (unless a real tag is in the antenna field, in which case the test is aborted).
  - Full status report check.

- Automated virtual tag single shot tests.

  The transceiver can be configured to automatically activate a virtual tag single shot on a periodic basis. This test is done in order to verify that the transceiver is operating properly. It is especially useful if you have extended periods when no PIT tags are present. See page 31 for information on configuring the virtual test tag settings.

- Automatically and manually issue reports.

  A number of different reports can be generated automatically or manually. The reports provide status information about the transceiver. See page 35 for details.

Troubleshooting

This section provides solutions to the most common transceiver errors.

Warning! The transceiver must be powered off by toggling the power switch to off position (“0”) and disconnecting the power cord by unplugging it from AC power source before performing any repairs. Only qualified service personnel should access the internal components of the transceiver.

Transceiver does not power up

1. Open the transceiver enclosure and check if the DC voltage status LED (“DC OK”) on the DC power supply lights up when transceiver power switch is toggled to the On position. If not, toggle the switch to Off position and:
    a. Check proper power cord connection.
    b. Check all wire connections to the DC power supply.
    c. Check the fuse in the AC power entry module by opening the fuse cover and pulling out the fuse holder. If it is bad replace with: 3A, 250V, slow-blow, glass, 3AG fuse; Littelfuse p/n: 0313003.HXP or similar.
    d. If problem is not resolved transceiver must be sent to the manufacturer for repair.
2. If the “DC OK” LED lights up, check if LEDs on the Mother Board light up. If not, toggle the switch to the Off position and:
    a. Check all the DC power cable wire connections.
    b. Check the fuse F1 on the Mother Board by pulling it out of the socket. If bad replace with: 2A, 250V, time-lag T, thermoplastic, 8.5mm fuse; Schurter p/n: 0034.6618 or similar.
    c. If problem is not resolved transceiver must be sent to the manufacturer for repair.

No antenna connection detected

1. Check the antenna tuning.
2. Check the antenna connection and integrity.
3. Toggle the transceiver power switch to off position, open the transceiver enclosure and:
    a. Check the antenna port wire connections.
    b. Check all wire connections to the Antenna Interface Board.
    c. Check antenna wire connections to the Mother Board.
4. If problem is not resolved transceiver must be sent to the manufacturer for repair.

Checking and replacing the backup battery

The backup battery protects the memory from clearing and the internal clock from resetting when transceiver is powered off. When backup battery low voltage level detected:

1. Open the transceiver enclosure and check the backup battery proper connection.
2. Check the backup battery voltage. If below 2V toggle the transceiver power switch to the Off position and replace with new 3.6V, 2.1Ah, lithium battery pack with leads and connector; Tadiran Batteries p/n: TL-5242/W or similar.

   Note: The transceiver's memory will be cleared during battery replacement process. Be sure to download all tag IDs and short status reports contained in memory before turning the transceiver off and replacing the battery. See page 33 for details on the memory download process. Also, date and time will be lost and will need to be reset.
3. If problem is not resolved transceiver must be sent to the manufacturer for repair.

For all other problems

For all other problems that cannot be resolved by checking the proper wire or cable connections, the transceiver must be sent to the manufacturer for repair.

Maintenance

Warning! The transceiver must be powered off by toggling the power switch to off position (“0”) and disconnecting the power cord by unplugging it from AC power source before performing any maintenance. Only qualified service personnel should access the internal components of the transceiver.

The FS2020 Transceiver requires very little maintenance. To keep it operating at peak efficiency you should periodically do the following:

- Tighten all terminal connector screws
- Check all wire and cable connections
- Remove any dust
- Perform a full re-tune of the transceiver (see page 13)

Antenna Current Measurement Calibration Procedure

The transceiver antenna current measurement is calibrated and tested at the factory. But sometimes, due to the installation environment, the properties of the antenna and antenna cable, and/or component degradation, the transceiver current measurement might require slight adjustments for the most accurate performance. The calibration is done by setting the proper **Current Measurement Gain** and **Current Measurement Offset** values.

Care should be taken to avoid any injuries or damage to the transceiver. Present settings of all adjustments should be noted and recorded for backup.

Tools Required

- PC or a laptop computer with communication software packages such as BioTerm, HyperTerminal, ProComm or other
- Oscilloscope
- Current probe Tektronix P6021 or equivalent
- Potentiometer adjustment tool or small flat blade screwdriver

The following procedure will help guide **qualified personnel** in the steps necessary to calibrate the transceiver antenna current measurement:

1. Turn off the transceiver.
2. Open the transceiver enclosure and attach the current probe to the white antenna wire at the Mother Board.
3. Attach the current probe to the oscilloscope.

   Set the oscilloscope to display antenna current signal at the maximum possible resolution and to measure the signal peak to peak.
4. Turn on the transceiver and establish a connection with the computer using local USB Port.
5. Reduce the DC Power Supply Voltage to its lowest level by turning the adjustment counter-clockwise until it stops.
6. Record the antenna current signal measurement on the oscilloscope (I_L).
7. Obtain the antenna current raw measurement by sending the “MCR” command to the local port (ADC_L).

   This is the measurement signal level at the input of ADC (analog-to-digital converter). For more accurate calibration obtain a few raw measurements and use the average value.
8. Increase the DC Power Supply Voltage to its highest level by turning the adjustment clockwise until it stops.
9. Record the antenna current signal measurement on the oscilloscope (I_H).
10. Obtain the antenna current raw measurement by sending the “MCR” command to local port (ADC_H).

    This is the measurement signal level at the input of ADC (analog-to-digital converter). For more accurate calibration obtain a few raw measurements and use the average value.
11. Use the following formulas to calculate the current measurement gain and offset values:

    $GAIN = ((I_H - I_L) / (ADC_H - ADC_L)) * 1000$

    $OFFSET = (I_L – (ADC_L * GAIN)) * 1000$

12. Set the new values of the current measurement gain and offset by sending the following commands to the local port:

    MCG{GAIN}

    MCO{OFFSET}

13. Verify the calibration results by matching the transceiver's antenna current measurement to the oscilloscope measurement at different DC Power Supply Voltage levels.
14. Set the proper DC Power Supply Voltage level to achieve desired antenna current.
15. Turn off the transceiver.
16. Detach the current probe from the white antenna wire at the Mother Board.
17. Close the transceiver enclosure and turn the transceiver back on.

Updating the Transceiver Firmware

Note: The transceiver's memory will be cleared during the firmware update process. Be sure to download all tag IDs and short status reports contained in memory before initiating the update process. See page 33 for details on the memory download process.

New or updated firmware may periodically become available for the transceiver. To update the transceiver firmware:

1. Install the Silicon Labs CP210x USB to UART Bridge Virtual COM Port (VCP) Windows drivers on the computer used to communicate with the transceiver:

   Note: The drivers installation file is supplied on the USB Flash memory device included with the transceiver. Or to download the latest version follow the link: http://www.silabs.com/products/mcu/pages/usbtouartbridgevcpdrivers.aspx.

2. Install the *AppProg 1.14* programming application on the computer used to program the transceiver.

   Note: The installation file is supplied on the USB Flash memory device included with the transceiver.

3. Create a directory named *FS2020 Application Firmware vx.x* on the computer (x.x is a version of the new firmware to be programmed).

4. Download the latest application firmware archive file *FS2020 Application Firmware vx.x.zip* and copy it to the directory.

   Note: Instructions on how to download this file will be provided in a firmware update release memo.

5. Extract all files from this archive to the directory.

6. Establish a connection to the transceiver.

   If you are performing this procedure locally you should use the USB port. If the procedure is being performed remotely you must use the fiber optic ports. Be sure to switch the Remote Port Protocol to ASCII when using the fiber optic ports. The firmware update procedure using the Ethernet port is not supported.

7. Close all communication applications that could use the communication link between the computer and the transceiver.

8. Open the *AppProg 1.14* programming application.

9. Click on the **Filename** field and open the application definition file *FS2020 Application vx.x.ini*.

10. If necessary, click on the **Comm. Settings** field and change the communication port settings to match the port number and speed that is used to connect to the transceiver.

11. Click **Download**.

    A progress bar will show when the download is complete.

    After the download is successfully completed the transceiver will reset.

12. Close the *AppProg 1.14* programming application.

13. To confirm that the new firmware has been successfully downloaded to the transceiver use any of the following methods:

a. During the power-up process the application firmware version is displayed in the initial boot screen.

b. Press **Status > Device Info** on the transceiver console to display the firmware version.

c. Generate a firmware version report by selecting **Setup > Reports > Report Firm. Versions** on the transceiver console or by using the **RFV** command via any available communication port connection.

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